Technical Information

Explosion Protection

TI 33Q01J30-01E

YOKOGAWA

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Introduction

This book describes explosion protection compliance of CENTUM 3000 and CENTUM VP (hereinafter CENTUM.) Some parts of this book will occupy the general explanation about explosion protections, but it mainly explains what explosion protection complied with CENTUM which is an integrated production control system, and what regulation it has.

The engineering practice of explosion protection is regulated by each country, and in principle, the wiring and the other methods for construction should be done in accordance with safety standards. When you implement the explosion protection system on the job, select the products as to comply with the standards of the country in which it is used, and the methods for construction should be researched.

Furthermore, this document contains the details of the NFM020-A13 and IFM035-A07 certificates that are included in the product documentation.

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Safety Precautions

Safety, Protection, and Modification of the Product

- In order to protect the system controlled by the product and the product itself and ensure safe operation, observe the safety precautions described in the Technical Information (this book and Installation Guidance) and the User's Manuals. Yokogawa Electric Corporation ("YOKOGAWA") assume no liability for safety if users fail to observe these instructions when operating the product.
- If this product is used in a manner not specified in the Technical Information (this book and Installation Guidance) and the User's Manuals, the protection provided by this product may be impaired.
- If any protection or safety circuit is required for the system controlled by the product or for the product itself, prepare it separately.
- Be sure to use the spare parts approved by YOKOGAWA when replacing parts or consumables.
- Do not use the accessories (Power supply cord set, etc.) that came with the product for any other products.
- Modification of the product is strictly prohibited.
- The following symbols are used in the product and instruction manual to indicate that there are precautions for safety:

Indicates that a caution must be given for operation. This symbol is placed on the product where the user is recommended to refer to the instruction manual in order to protect the operator and the equipment against dangers such as electrical shocks. In the instruction manuals you will find precautions to avoid physical injury or death to the operator, including electrical shocks.

Indicates that caution is required for hot surface. Note that the devices with this symbol become hot. The risk of burn injury or some damages exists if the devices are touched or contacted.

Identifies a protective conductor terminal. Ensure to ground the protective conductor terminal to avoid electric shock before using the product.

Identifies a functional grounding terminal. A term "FG" is also used. This terminal is equipped with the same function and used for purposes other than the protective grounding. Before using the product, ground the terminal.

Indicates an AC supply.

Indicates a DC supply.

Indicates that the main switch is ON

Indicates that the main switch is OFF

Symbols in this Book

This book has the following symbol.

CAUTION

Describes the considerations about the danger that the failure of handling causes the operators' life and body.

WARNING

Identifies instructions that must be observed in order to prevent the software or hardware from being damaged or the system from becoming faulty.

IMPORTANT

Identifies important information required to understand the operations or functions.

TIP

Identifies additional information.

SEE ALSO

Identifies a source to be referred to.

Cautions for Safely Applying the Device

Power Supply Wiring

CAUTION

The connection of power cables and the selection of power cables must be done in accordance with this book and the Installation Guidance, and implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

Ground Wiring

CAUTION

You should implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

Input/Output Wiring

CAUTION

The connection of input and output should be done in accordance with this book and the Installation Guidance, and implement so as to comply with the standards and laws about explosion protection in the country or the area where the cables are laid.

- Wiring material and equipment which is electrically connected to this equipment should be products that complied with standards and laws about explosion protection in the country or the area where the cables are laid.

Replacement of fuse

CAUTION

- The specified fuse must be used to replacement.
- Before replacing fuse, confirm if there's no dangerous gas, and the power supply is OFF.

Maintenance

CAUTION

- The maintenance work should be done only by operators who received special training.
- Use a vacuum cleaner and soft cloth to clean up the equipment.
- At the time of the maintenance work, put on wrist straps and take the measures for ESD (Electrostatic Discharge).
- If the label that indicates Danger is not legible, or if it has peeled off, order a new label using part number T9029BX.
- Before starting the maintenance work, confirm if there's no dangerous gas.

Drawing Conventions

Some drawings depicted in the user's manual may be partially emphasized, simplified, or omitted for the convenience of description.

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Trademarks

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- FOUNDATION of FOUNDATION fieldbus is a registered trademark of Fieldbus Foundation.
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CENTUM
Explosion Protection

TI 33Q01J30-01E 15th Edition

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1. Overview of Explosion Protection

This chapter provides the general explanation about explosion protection.

1.1 Primary Explosion Protection and Secondary Explosion Protection

In order to prevent explosions and its danger, plants must have an effective explosion protection. To prevent explosions of plant, as a comprehensive countermeasure, the following steps must be taken.

(1) Step to prevent generating dangerous explosive atmospheres

(2) Step to prevent ignition to explosive atmospheres

(3) Step to limit the influence of explosion within the security area

Steps such as (1) are called Primary explosion protection, Steps such as (2), (3) are called Secondary explosion protection.

Primary Explosion Protection

Primary explosion protection is a step to avoid the formation of potentially explosive atmospheres. It includes removing explosive gas and chemically changing explosive gas into non-explosive gas.

Secondary Explosion Protection

Secondary explosion protection is a step to keep the influence of explosion to a minimum. In order to prevent the ignition, it pays attention to the electric circuit area of equipment in plant that may cause it. Moreover, if it happens, it prevents the propagation of the influence to the exterior.

CENTUM-compliant explosion protection products are for Secondary explosion protection. The following chapters in this book mostly describe Secondary explosion protection.

1.2 Explosion Protection Standards

ATEX Directive

In Europe, European Community (EC) directive 94/9/EG (March 23, 1994) was issued. This is a new directive about explosion protection in Europe. On all the EC countries, it puts an obligation to pay attention and assure the safety and health mainly for persons. This directive goes by the name of ATEX. As one of the CE marking adaptation directive, it has been compulsory since July 2003. ATEX means “Atmospheres Explosibles” in French, and “Potentially Explosive Atmospheres” in English.

The target of this regulation is also the usage of equipments that are used at hazardous area, and the explosion protection electric equipments/accident prevention systems that are used in potentially explosive atmospheres. Since July 1, 2003, in EC area, although the product complies with ATEX explosion protection standard, in addition to this, it should comply with “ATEX directive” about CE marking, and should have a specific indication. Unless it complies with the directive, the explosion protection products are not allowed to be launched on the market in EU countries. In order to comply with this directive, EN standard is undergoing revisions.

1.3 Classification of Explosion Protection Equipment

Explosion protection equipment is classified as follows:

- Classification by to explosion protection constructions: what kind of method is taken for explosion protection?
- Classification by hazardous area and explosive gas: in what kind of environment are they used?

Classification by Explosion Protection Constructions

Type of explosion protection constructions are listed in the following table.

Table Type of explosion protection constructions

Type of explosion protection constructions	Abbreviation of standard
Flame-proof enclosures	Type “d”
Pressurized apparatus	Type “p”
Increased safety	Type “e”
Oil immersion	Type “o”
Intrinsic safety	Type “i”
Powder filling	Type “q”
Encapsulation	Type “m”
Type of protection “n”	Type “n”
Non-Incendive	-

Classified roughly, explosion protection constructions include 4 types of the principle as below.

(1) It isolates the potentially explosive atmospheres from the place where sparks and high temperature arise and prevents explosions. The constructions based on this principle include Pressurized apparatus, Oil immersion, and Encapsulation.

(2) It keeps an explosion within the enclosure, if it is induced there. The constructions based on this principle include Flame-proof enclosures.

(3) Even if sparks and heat is caused by an electric accident at the normal operation, it prevents ignitions of potentially explosive atmospheres. The constructions based on this principle include Increased safety, Type of protection “n”, Non-Incendive.

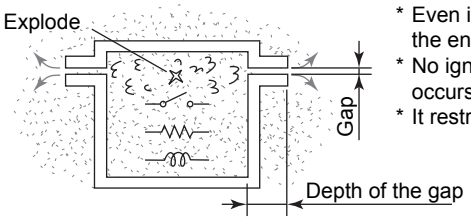
(4) If an electric accident such as short-circuit, ground fault, and burnout occurs, it doesn’t ignite potentially explosive atmospheres, because of the system which the specific intrinsic safety circuit is installed in. The constructions based on this principle include Intrinsic safety. Intrinsic safety construction has the ia equipment, the ib equipment, and the ic equipment. The ia equipment maintains its performance of explosion protection even if it has two defects, it is able to react Zone 0 (Division 1). The ib equipment maintains its performance of explosion protection even if it has one defect, it is able to react Zone 1 (Division 1). The ic equipment maintains its performance of explosion protection under normal operating conditions only, it is able to react Zone 2 (Division 2).

Definition and Comparison of Explosion Protection Construction

Flame-proof Enclosures (Type “d”)

1) Definition: “Flame-proof enclosures” is totally enclosed construction. When gas or vapor get into the enclosure and an explosion take place, the enclosure withstands the pressure of explosion and prevents the ignition of explosion fire to gas and vapor surrounding the enclosure.

2) Construction



* Even if explosion occurs inside the container, the enclosure withstands it.
* No ignition occurs outside even if explosion occurs inside the container.
* It restricts the surface temperature of the enclosure.

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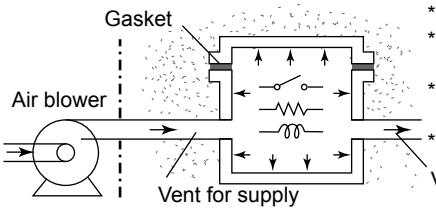
Figure Flame-proof Enclosures (Type “d”)

Pressurized Apparatus (Type “p”)

1) Definition: “Pressurized apparatus” supplied protective gas such as air, nitrogen, and carbon dioxide into the enclosure, so that gas or vapor doesn’t get into the enclosure.

2) Construction



* It increases the internal pressure of the enclosure.
* Protective gas is filled in the container before turning the power on.
* It shuts off the power, when the internal pressure decreases.
* It restricts the surface temperature of the enclosure.

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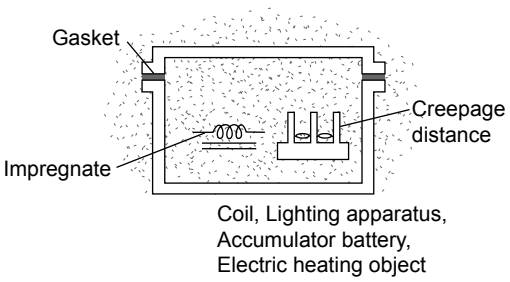
Figure Pressurized Apparatus (Type “p”)

Increased Safety (Type “e”)

1) Definition: When a part of electric machine and apparatus (except insulating parts), which has no possibility of the creation of sparks or arc, is under normal operation and turned on electricity, “Increased safety” increases the insulation performance and the level of safety for danger of the unacceptable high temperature and the external damage.

2) Construction



* Measures to increase the level of safety so as not to spark.
  • Coil is impregnated.
  • Wires are connected so as not to slip.
  • Creepage distance/insulation distance is kept.
  • Tracking property of insulating material.
* It restricts the surface temperature of the coil, etc.
* An enclosure catching no dust is used (IP54/IP44).

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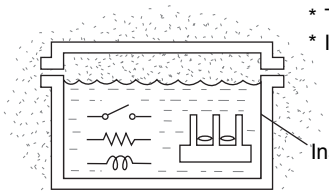
Figure Increased Safety (Type “e”)

Oil Immersion (Type “o”)

1) Definition: “Oil immersion” is an explosion protection construction that a part of electric machine and apparatus, which may create sparks or arcs and may become an ignition source by unacceptable high temperature, is immersed in insulating oil, so as not to ignite to gas or vapor.

2) Construction



* The electric circuit immersed in insulating oil.
* It restricts the surface temperature of enclosure and oil.

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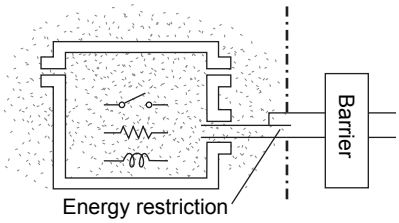
Figure Oil Immersion (Type “o”)

Intrinsic Safety (Type “i”)

1) Definition: “Intrinsic safety” is the explosion protection construction confirmed that the sparks, arcs or heat, which the component part of the electric machine and apparatus create, have no possibility of ignition to gas or vapor, by the spark ignition test and so on.

2) Construction



* It has no ignition to gas, even if it's under abnormal situation.
  - It restricts the electric energy.
  - Creepage distance/insulation distance is kept.
  - It restricts the surface temperature of electric component and so on.
* A barrier is necessary.
* IP22 enclosure (technical standard)

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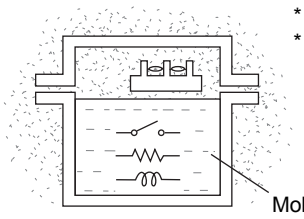
Figure Instrinsic Safety (Type “i”)

Encapsulation (Type “m”)

1) Definition: “Encapsulation” is the explosion protection construction that parts which may ignite potentially explosive atmospheres by heating are embedded in sealing compound, so that potentially explosive atmospheres cannot be ignited.

2) Construction



* The electric circuit is encapsulated by resin.
* It restricts the surface temperature of enclosure and resin.

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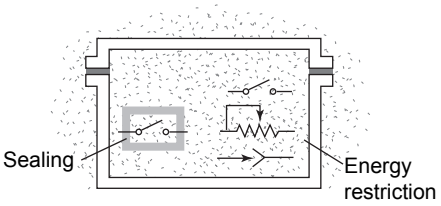
Figure Encapsulation (Type “m”)

Type of Protection “n” or Non-Incendive

1) Definition: “Type of protection “n” or Non-Incendive” is the special explosion protection construction for Zone 2 or Division 2. It is applicable to electric equipments which is not capable of igniting potentially explosive atmospheres under normal operation.

2) Construction



* Under normal operation, it restricts the electric sparks and so on.
  • It seals the component that creates sparks.
  • It restricts the energy that creates sparks.
  • Creepage distance/insulation distance is kept.
  • It restricts the surface temperature of electric component.
* The enclosure withstands the shock.
* The enclosure is sealed (BS standard).

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Figure Types of Protection “n” or Non-Incendive

Classification by Hazardous Area and Explosive Gas

Classification of Hazardous Area

In the plant which handle flammable gas or vapor, when they are emitted and mixed with air while at work, “potentially explosive atmospheres” are generated. The area that has a risk of explosion is called “Hazardous area”.

Zone 0: potentially explosive atmospheres exist continuously or for a long time (at all time)

Zone 1: potentially explosive atmospheres may exist under normal operation of the plant and so on (sometime)

Zone 2: no potentially explosive atmospheres exist under normal operation of the plant and so on, or exist briefly if they do (at accidents only)

Table Classification of Hazardous Area

Europe Australia	U.S. Canada	Explosion protection approved equipment
Zone 0	Division 1	Intrinsic safety (ia)
Zone 1	Division 1	Intrinsic safety (ia) Flame-proof enclosures, Increased safety Pressurized apparatus, Oil immersion
	Division 2	Intrinsic safety (ib) Flame-proof enclosures, Increased safety Pressurized apparatus, Oil immersion
Zone 2	Division 2	Intrinsic safety (ia, ib, ic) Flame-proof enclosures, Increased safety Pressurized apparatus, Oil immersion Type of protection “n” Non-Incendive

Classification of Explosive Gas

Classification of Explosive gas (vapor) involves a division by explosion intensity and a division by explosion energy. Classifications in the technical standard, IEC, and ATEX are listed in the following table.

Table Classification of Explosive Gas

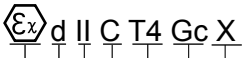
Classification	Flame-proof enclosures	Intrinsic safety	Major gas
	Maximum gap in mm where the fire runs, when the depth of joint surface is set to 25 mm	Minimum ignition current ratio of the target gas, when the minimum ignition current of methane, which is calculated by spark ignition test equipment, is assigned 1	
A	0.9 or more	More than 0.8	Propane, Methane
B	More than 0.5, 0.9 or less	0.45 or more, 0.8 or less	Ethylene
C	0.5 or less	Less than 0.45	Hydrogen, Acetylene

The United States and Canada have another classification.

1.4 Symbols That Indicate Specifications of Explosion Protection

Each country has its own symbols. The following is an example of symbols.

Europe, Australia, IEC



Indicates that it is an explosion protection equipment

Indicates the explosion protection construction

ia, ib, ic: Intrinsic safety	o: Oil immersion
d:Flame-proof enclosure	nA, nC, nR: Type of protection “n”
px, py, pz: Pressurized enclosure	ma, mb, mc: Encapsulation
e: Increased safety	q: Power filling

Indicates the usage (for where)
- I: for coal mines
- II: for plants

Indicates the classification of gas
- A: propane etc.
- B: ethylene etc.
- C: hydrogen, acetylene

Temperature class
(equipment/maximum surface temperature of component)
- T1: 450°C or less
- T2: 300°C or less
- T3: 200°C or less
- T4: 135°C or less
- T5: 100°C or less
- T6: 85°C or less

Equipment Protection Levels (EPL)
- Ga: equipment for explosive gas atmospheres, having a ‘very high’ level of protection
- Gb: equipment for explosive gas atmospheres, having a ‘high’ level of protection
- Gc: equipment for explosive gas atmospheres, having a ‘enhanced’ level of protection
- Da: equipment for combustible dust atmospheres, having a ‘very high’ level of protection
- Db: equipment for combustible dust atmospheres, having a ‘high’ level of protection
- Dc: equipment for combustible dust atmospheres, having a ‘enhanced’ level of protection

Specific conditions of use

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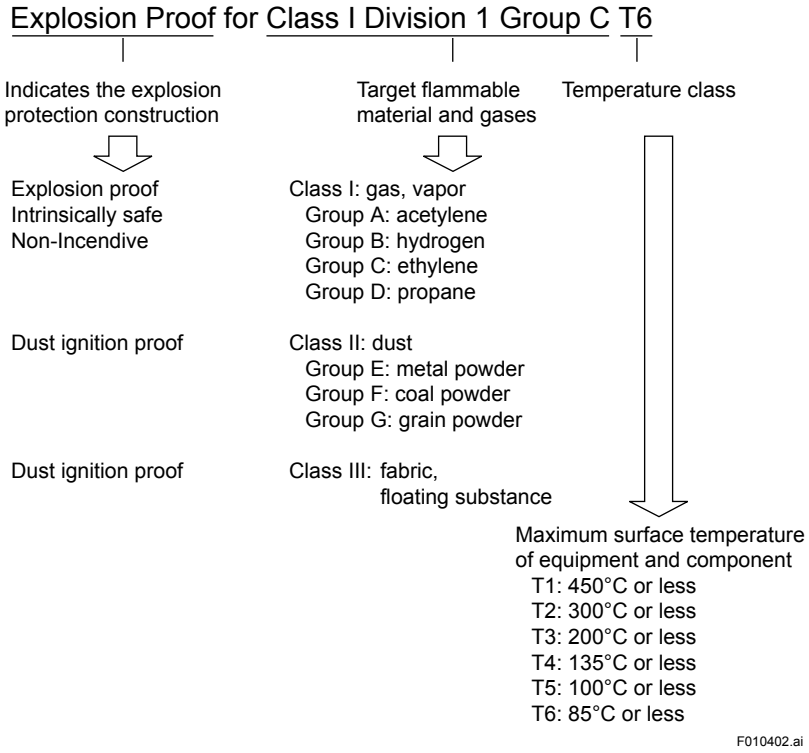
Note: The symbols differ slightly between countries.

The United States, Canada



2. CENTUM and Explosion Protection Instrumentation

2.1 Explosion Protection Standards that CENTUM has Acquired

There are various standards for explosion protection in each region. Therefore, when equipment tries to be used in a certain region, the equipment needs to be an approved product with explosion protection standards adopted in the region. CENTUM, a global product, has complied the standards adopted in North America and Europe.

The table below lists the explosion protection standards that CENTUM complies and their approval authorities. As shown in the table, RIO equipment has acquired CSA standard regarding Non-Incendive and can be installed in Zone 2 or Division 2 hazardous areas. This chapter mainly describes the explosion protection compliance of FIO equipment. See Appendix for the explosion protection compliance of RIO equipment.

Table Explosion Protection Standards that CENTUM Complies

Explosion protection construction	Conformed standard number	Testing authorities	Appropriate equipment
CSA Non-Incendive	CAN/CSA-C22.2 No. 0-M91 CAN/CSA-C22.2 No. 0.4-04 C22.2 No. 213-M1987 (for 100-120 V AC and 24 V DC power supply)	CSA	FIO (Field network I/O), RIO (Remote I/O) and associated equipment
FM Nonincendive	Class 3600:2011 Class 3611:2004 Class 3810:2005 (for 100-120 V AC, 220-240VAC, and 24 V DC power supply)	FM	FCU (Field Control Unit), FIO and associated equipment Module with built-in barrier (FIO)
FM intrinsic safe explosion protection	FM Class Number 3610: 2010 ANSI/ISA-60079-0:2009 ANSI/ISA-60079-11:2009	FM	Module with built-in barrier (FIO)
Type “n”	EN 60079-0: 2012 EN 60079-15: 2010 (for 24 V DC power supply)	Self-declaration	FIO and associated equipment
	EN 50021:1999 (for 24 V DC power supply)		Module with built-in barrier (FIO)
Type “i” (intrinsic safety explosion protection)	EN 50020:1994 EN 50014:1997 + A1 + A2	PTB	Module with built-in barrier (FIO)

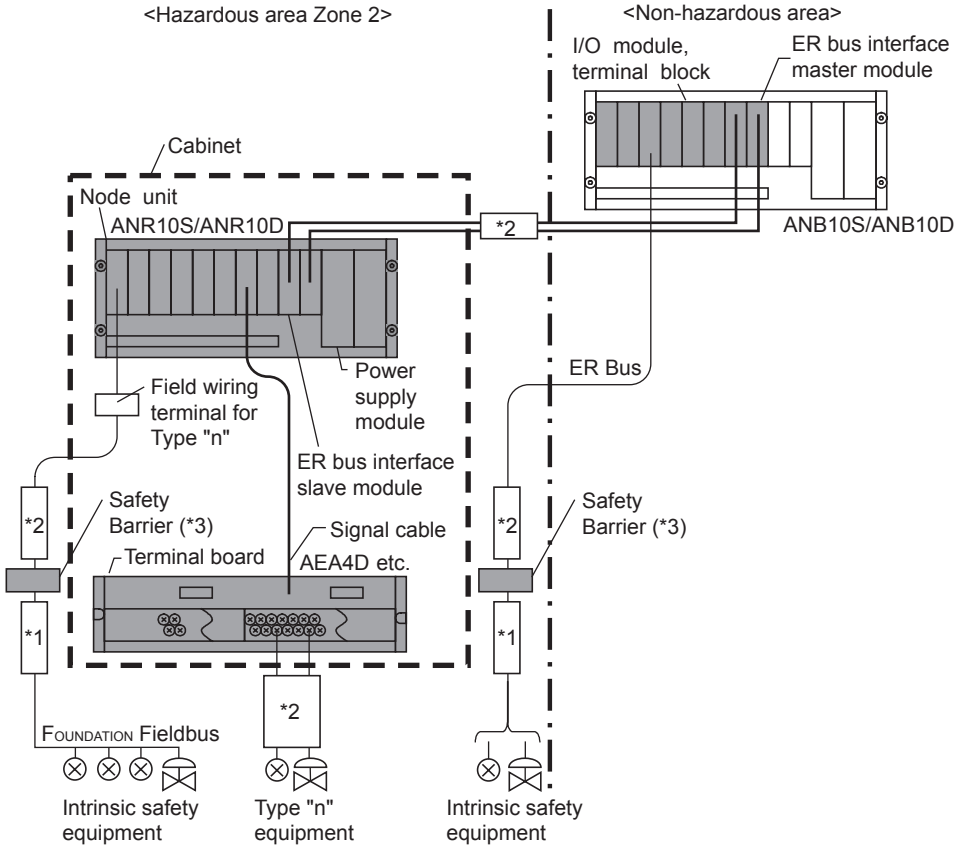
2.2 Explosion Protection Construction that I/O Devices of CENTUM Comply

As described in 2.1, countries define their own standards and rules regarding technical methods for explosion protection. With CENTUM, NI, Type “n” and intrinsic safety explosion protection are adopted as explosion protection construction for the installation of FCS or node unit in hazardous areas. The adoption of NI and Type “n” with FIO devices of CENTUM allows FCS or node unit to be installed in Class II hazardous area (Division 2, Zone 2) which covers most hazardous areas. This provides more variety of instrumentation.

Module with built-in barrier of FIO are equipment compliant with intrinsic safety explosion protection and are the modules that can be connected to the devices installed in Zone 0, Zone 1 and Zone 2 (Division 1, Division 2).

To install FCS or node unit in a hazardous area, the node itself and the terminal board as well as the I/O modules should acquire standards. The figure bellow shows one example of Type “n” standard compliant devices. The devices shown in half-tone dot meshing and the cables shown in heavy line are Type “n” compliant products. The same is with NI compliant devices. FCS or node unit can be installed in Zone 2 (Division 2). See “5.2 List of Type “n” Compliant Products for the list of intrinsic safety explosion protection compliant devices.

See the tables in Appendix for details of each CENTUM equipment and their approved standards.



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region
*2: Explosion-proof wiring for Type”n” equipment that is defined in EN 60079-14 and the rules/standards of each country or region
*3: Explosion-proof structure for hazardous area is required.

Figure Example of Type “n” Standard Compliant Devices

2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area

This section describes the overview of connecting CENTUM to the devices installed in a hazardous area by giving some examples.

Overview of Connecting a Module with Built-in Barrier (Equipment Compliant with Intrinsic Safety Explosion Protection) with Devices

Overview of Connecting a Module with Built-in Barrier (Compliant with ATEX Standard)

A module with built-in barrier can be connected to the devices installed in Zone 0, Zone 1 and Zone 2. For connecting to the devices installed in Zone 0, Zone 1 or Zone 2, it is necessary to compare intrinsic safety parameters between the devices installed and the module with built-in barrier to evaluate whether connection is possible or not.

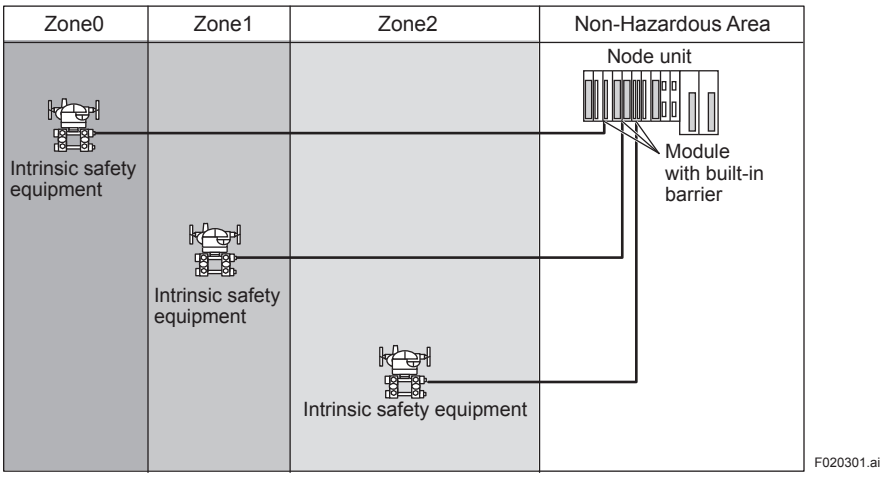


Figure Connection of a Module with Built-in Barrier (Compliant with ATEX Standard) (1)

Module with built-in barrier itself can be installed in Zone 2.

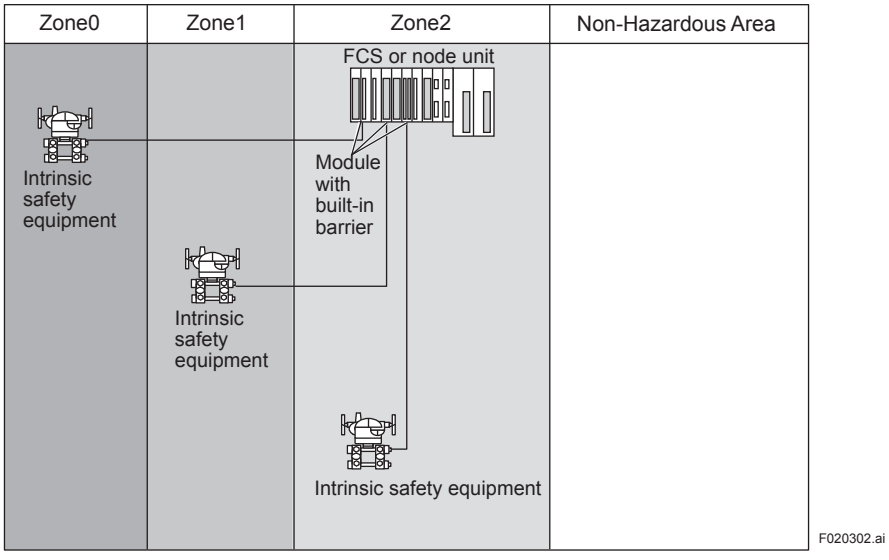


Figure Connection of a Module with Built-in Barrier (Compliant with ATEX Standard) (2)

Overview of Connecting a Module with Built-in Barrier (Compliant with FM Standard)

A module with built-in barrier can be connected to the devices installed in Division 1 and Division 2. For connecting to the devices installed in Division 1 or Division 2, it is necessary to compare intrinsic safety parameters between the devices installed and the module with built-in barrier to evaluate whether connection is possible or not.

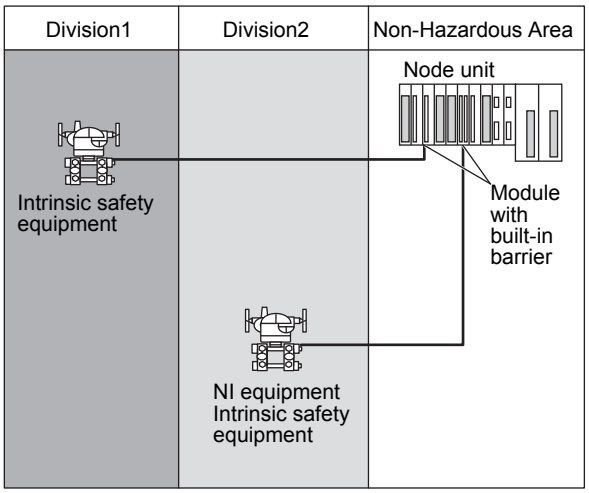


Figure Connection of a Module with Built-in Barrier (Compliant with FM Standard) (1)

Module with built-in barrier itself can be installed in Division 2.

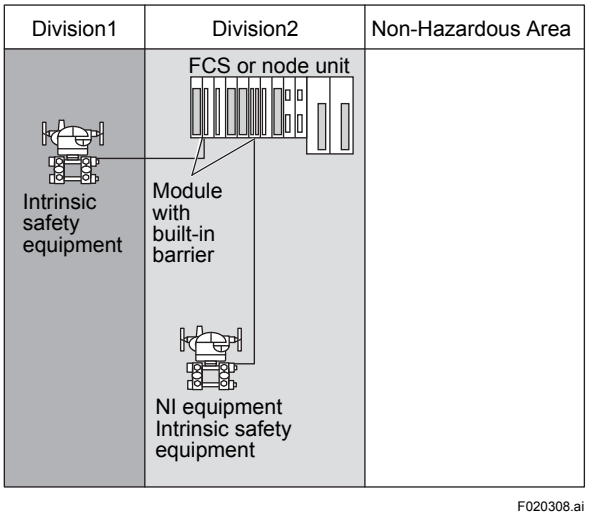


Figure Connection of a Module with Built-in Barrier (Compliant with FM Standard) (2)

Overview of Connecting a Type “n”-compliant FIO Module with Devices

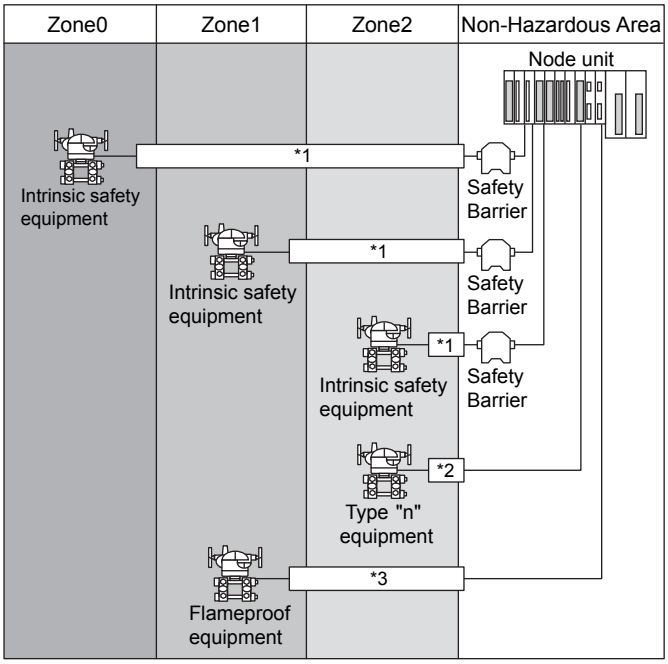
A Type “n”-compliant module can be connected to the intrinsic safety equipment installed in Zone 0, Zone 1 and Zone 2 using a barrier and explosion-proof wiring as shown in the following figures.

They can be connected to Intrinsic safety equipment installed in Zone 0, 1 and 2 using Explosion-proof wiring for intrinsically safe circuits that is defined in EN60079-14, EN60079-25 and the rules/standards of each country or region.

They can be connected to Type “n” equipment installed in Zone 2 using explosion-proof wiring for type”n” equipment that is defined in EN 60079-14 and the rules/standards of each country or region.

And they can be connected to flameproof equipment using explosion-proof wiring for flameproof equipment that is defined in EN 60079-14 and the rules/standards of each country or region.

A Type “n”-compliant module and FCS or node unit (24 V DC feeding type) can be installed in Zone 2 by mounting in a keyed metal cabinet with protection rating of IP54 or higher.



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region

*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

*3: Explosion-proof wiring for flameproof equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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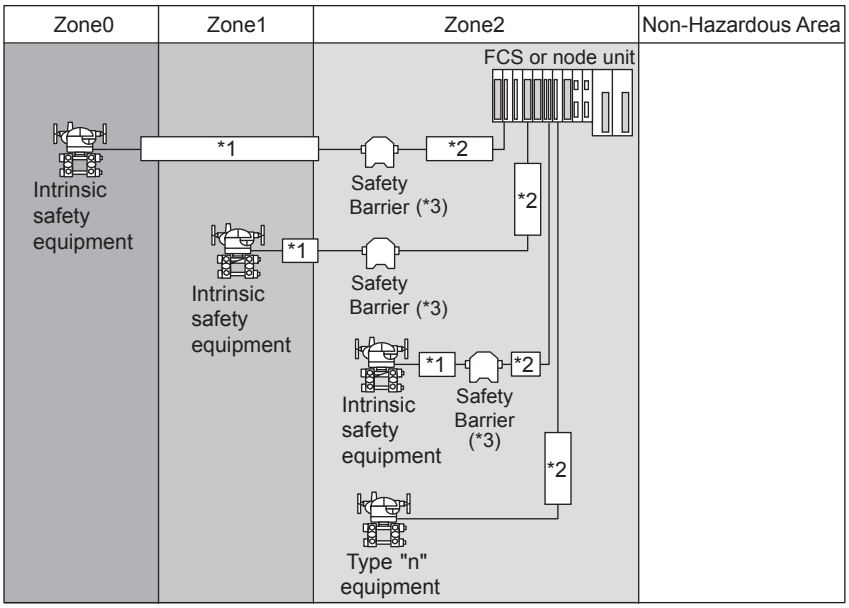
Figure Connection of a Type “n” Compliant Module (1)



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region.
*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region.
*3: Explosion-proof structure for hazardous area is required.

Figure Connection of a Type "n" Compliant Module (2)

Overview of Connecting Non-Incendive Compliant Module

NI-compliant module can be connected to the devices installed in Division 2. For the connection to an NI-compliant module, it is necessary to compare parameters between the device installed in a hazardous area and the device of CENTUM to evaluate whether connection is possible or not.

An NI-support module and FCS or node unit can be installed in Division 2 by mounting in a keyed metal cabinet approved by approval authorities.

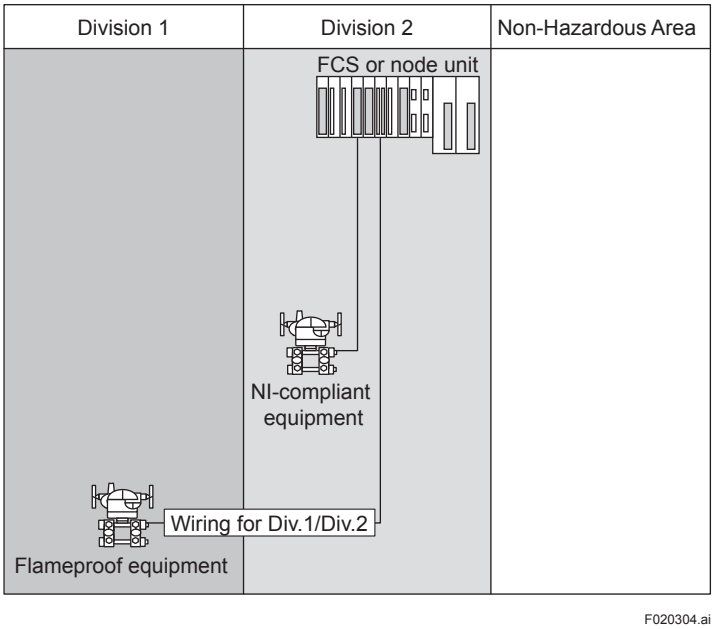


Figure Connection of an NI Compliant Module (1)

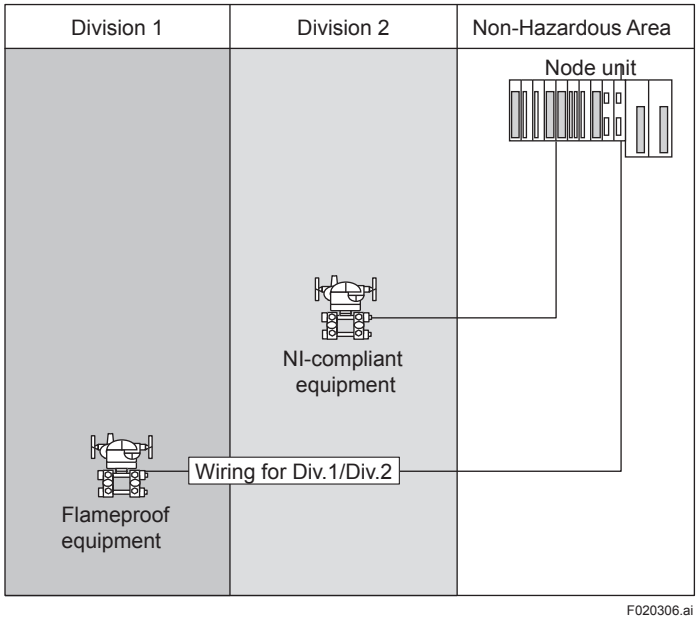


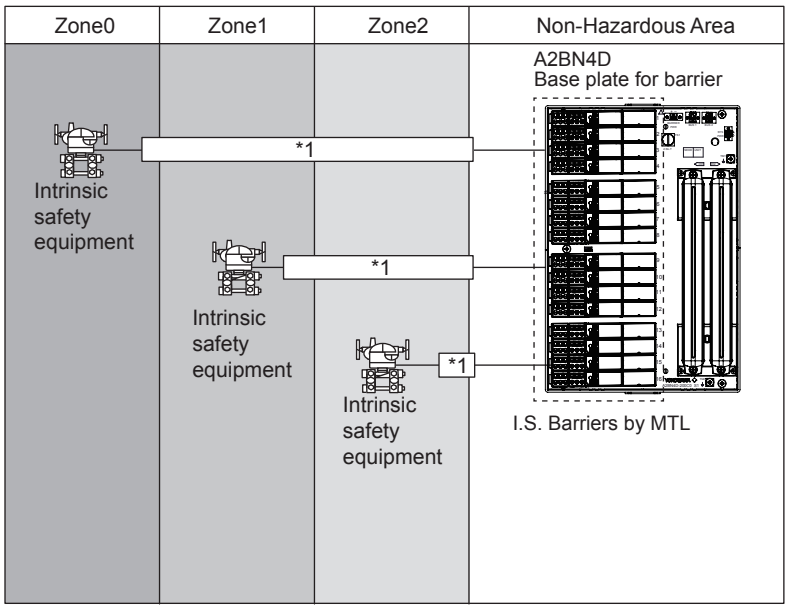
Figure Connection of an NI Compliant Module (2)

Overview of Connecting N-IO Components

N-IO components cannot be installed at hazardous area.

Intrinsic safety (hereinafter I.S.) barriers (*1) from MTL Instruments Group Limited (hereinafter MTL) which can be mounted to the base plate (A2BN4D), are complied with I. S. explosion protection standard. (*2) I. S. barriers can be connected to the I. S. equipment installed in the hazardous area with explosion-proof wiring as shown in the following figures.

*1: Refer to “Base Plates (for N-IO)” (GS 33J62F40-01EN).
*2: I.S. Barriers shall be installed and used in accordance with the instruction manual by MTL.



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region.

3. Explosion Protection Instrumentation in Zone 2/Division 2

3.1 Non-Incendive

Non-Incendive (hereafter described as NI), especially in North America, represents one of the explosion protection constructions for explosion-proof apparatus used in hazardous areas.

NI is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation.

3.1.1 CSA NI (CSA Non-Incendive)

A node unit for FIO, an I/O module (FIO), node interface units for RIO and an I/O module (RIO), and an optic repeater of CENTUM have acquired CSA NI certificates of the following standards from CSA.

This approval proves that the products above can be used in hazardous areas such as Class I and Division 2(*1) and that the I/O module can be directly connected to an CSA NI approved field device installed in hazardous areas such as Class I and Division 2.

In addition, an I/O modules (FIO or RIO) installed in non-hazardous areas can be directly connected to an CSA NI approved field device installed in hazardous areas such as Class I and Division 2.

*1: Class I, Division 2
This places where gases or vapors do not form a potentially explosive atmosphere in a normal state, or even if so, the atmosphere exists for only a short time.

Approved Types and Standards

Class I,Division2,GroupsA,B,CandDTemperature code T4

CAN/CSA-C22.2 No. 0-M91

CAN/CSA-C22.2 No. 0.4-04

C22.2 No. 213-M1987

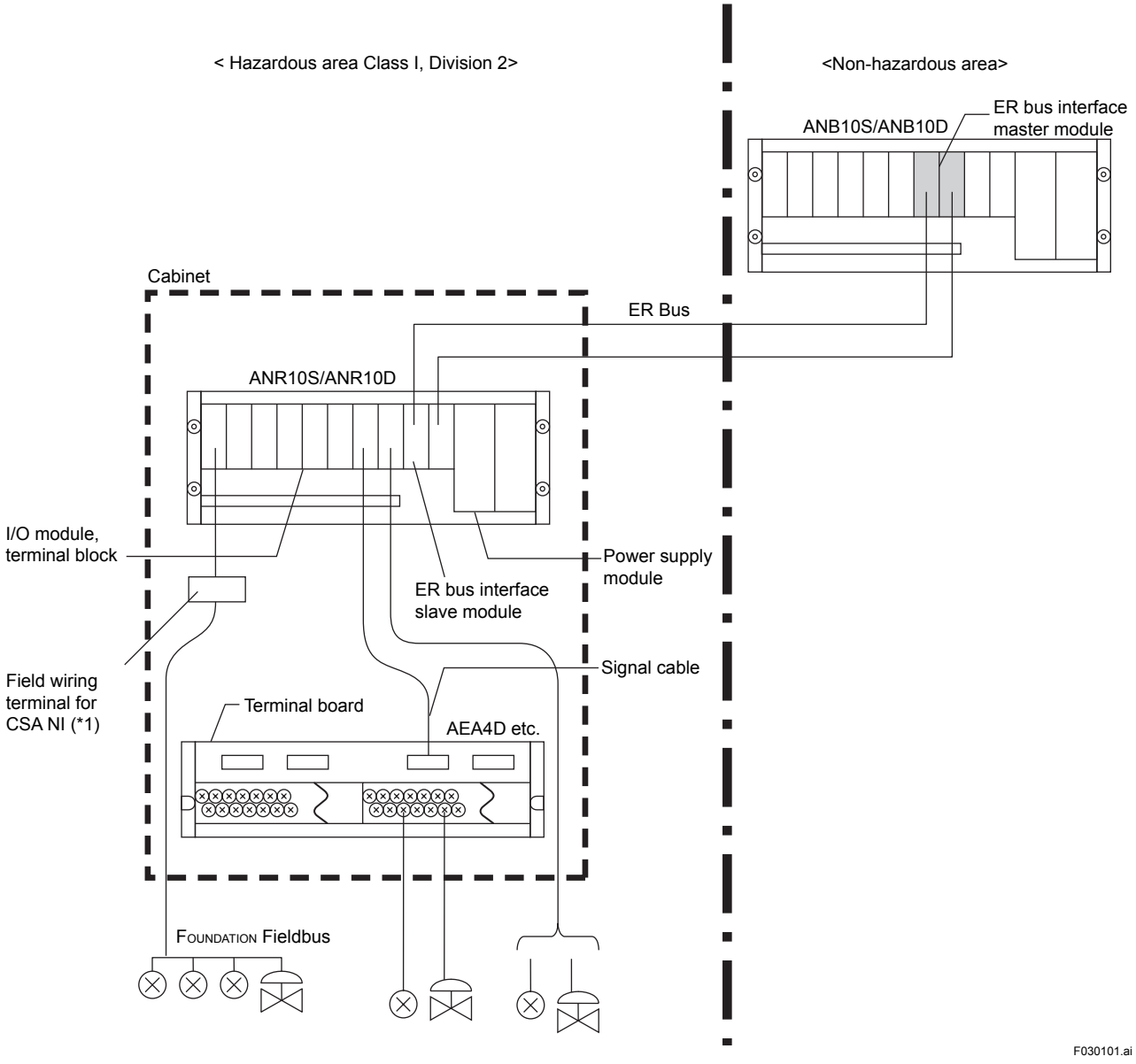
(for 100-120 V AC and 24 V DC power supply)

Precautions in Use

- To install a device in accordance with the standards above, the device needs to be accommodated in a keyed metal cabinet and installed. It is necessary to use a cabinet approved by CSA or local testing authorities for explosion-proof products.
- Use a cabinet which is larger than the size of W600 X H760 X D350 (mm) to mount a FIO node unit on.
- As a rule, NI explosion protection with a connection of a CSA standard approved device and an FM standard approved device shall not be approved. It is necessary to connect devices approved by the same standard.

CSA NI Approved Products and Their Configuration Example

The figure below is an example of the configuration of CSA NI approved products which can be installed in hazardous areas. See the table “The List of CSA NI Compliant Products” in Appendix for details.



*1: Use a barrier for a FOUNDATION fieldbus as a field wiring terminal for CSA NI. (Ex. barrier KLD2-PR-Ex1.IEC1)

Figure Example of the configuration of CSA NI approved products

Power Supply Wiring

The power cable of a node unit for FIO, a node interface unit for RIO and an optic repeater must be wired from the non-hazardous area by using Division 2 wiring dedicated in potentially explosive atmospheres such as a threaded metal conduit. In addition, it is necessary to be wired not to apply stress at the end of the cable.

When AED5D and A1BD5D are combined with ADV151, ADV161, ADV551 and ADV561, install an explosion-proof wiring defined in the relevant country for the wiring outside of the external power supply cable cabinet.

Wiring should be installed to conform to all wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

Signal Wiring

Cables other than power cables should be wired to conform to all wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

The following is special considerations.

- The cable (AKB332) connected to ADV141 and a field wiring need a Division 2 wiring dedicated in potentially explosive atmospheres such as a conduit wiring.
- When AAP135 is used in a power supply mode, the cable (KS1) connected to AAP135 and a field wiring need a conduit wiring.
- When a combination of ADV551 and AED5D or A1BD5D or that of ADV561 and AED5D or A1BD5D is used in a voltage output mode, a field wiring connected to AED5D or A1BD5D need a Division 2 wiring dedicated in potentially explosive atmospheres such as a conduit wiring.
- For ALF111, use a barrier for a fieldbus as a field wiring terminal for NI. (Ex. Barrier KLD2-PR-Ex1.IEC1)
- Use DC power supply compliant with the Standard for Explosion Protection for combination of ADV151 and AED5D or A1BD5D, or that of ADV161 and AED5D or A1BD5D in contact input mode and voltage input mode. Connection according to the parameters of this power supply makes signal wiring outside of the cabinet compliant with the local standard. Please read the instruction on contact input mode wiring and the instruction on voltage input mode when you actually install wiring.

Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.
Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

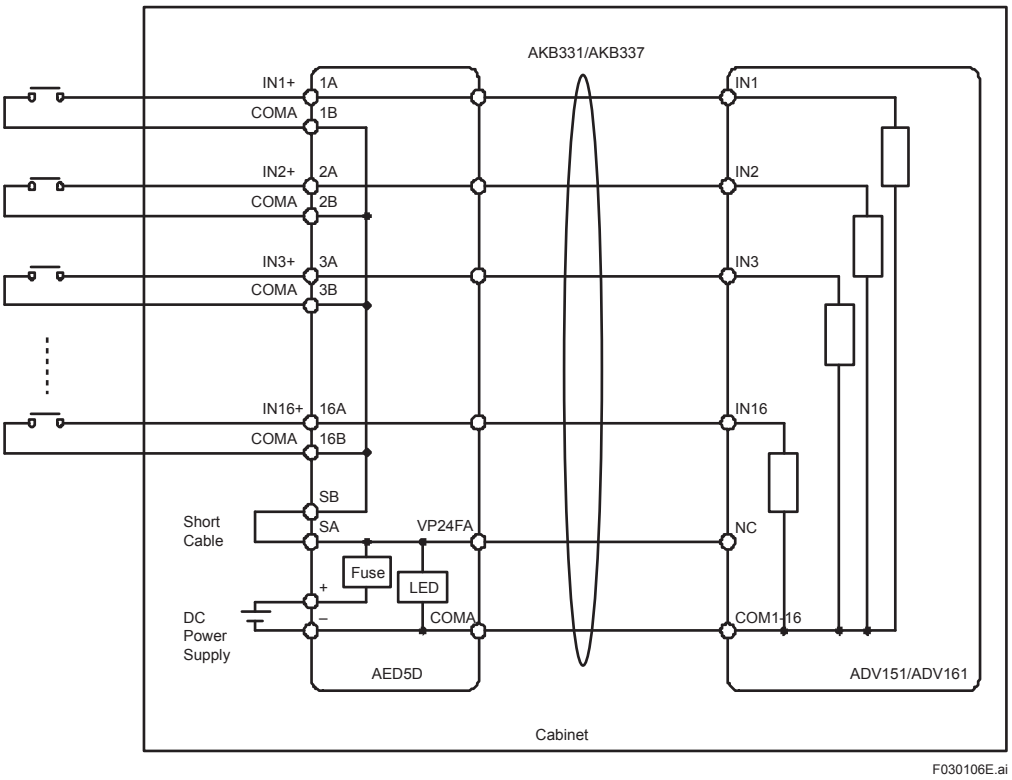


Figure Connection example of ADV151/ADV161 Contact Input Mode

Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

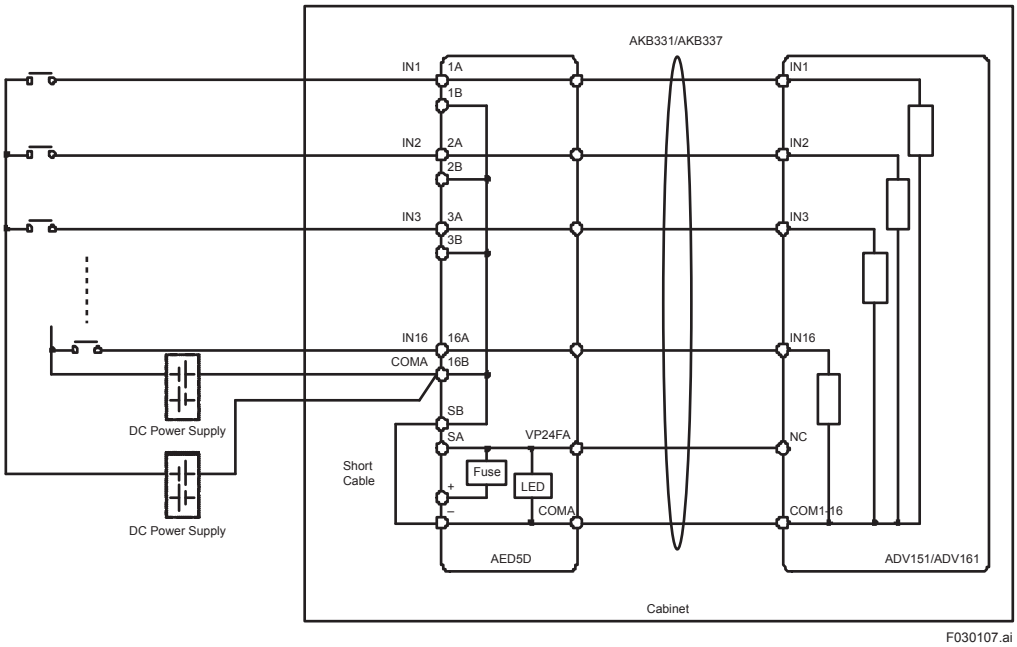


Figure Connection example of ADV151/ADV161 Voltage Input Mode

IMPORTANT

(1) Attaching or removing a cable, a fuse or a card

With the system in operation, never attach or remove a cable, a fuse or a card in a potentially explosive atmosphere.

(2) Maintenance of a product

When maintenance of a product is carried out with the system in operation, never attach or remove the product in a potentially explosive atmosphere.

<English>

WARNING-EXPLOSIVE HAZARD-

DO NOT DISCONNECT WHILE CIRCUIT IS LIVE UNLESS AREA IS KNOWN TO BE NON-HAZARDOUS.

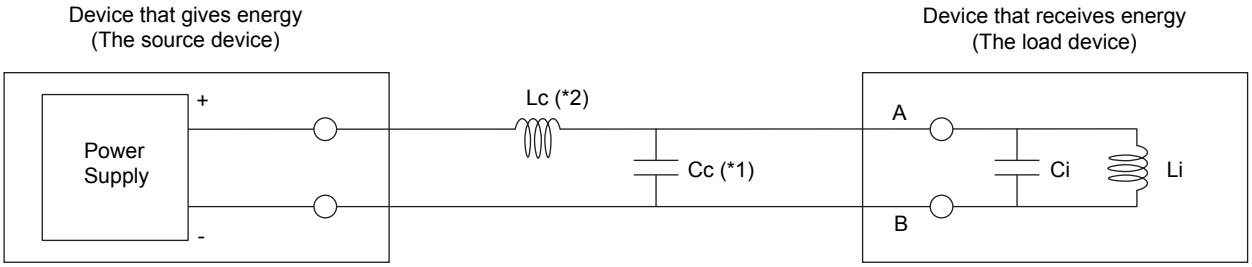
<French>

AVERTISSEMENT-RISQUE D'EXPLOSION. NEPAS DÉBRANCHER TANT QUE LE CIRCUIT EST SOUS TENSION, Á MOINS QU'IL NE S'AGISSE D'UN EMPLACEMENT NON DANGEREUX.

Parameters in Connecting with CSA NI Devices

Energy transfer influences CSA NI properties. In order to maintain these properties, parameters must be displayed when CSA NI devices are connected.

To display parameters, CSA NI devices are divided into the device that gives energy and the device that receives energy. The parameters displayed in each device are as follows.



Displayed parameters
Voc: maximum open-circuit output voltage
Isc: maximum short-circuit output current
Ca: maximum allowable capacitance
La: maximum allowable inductance
Cn: maximum allowable capacitance (in a normal circuit voltage of Vn)
Vn: normal circuit voltage
Ln: maximum allowable inductance (in a normal circuit current of In)
In: normal circuit current

*1: Cc: capacitance of the external wiring
*2: Lc: inductance of the external wiring

Displayed parameters
Vmax: maximum input voltage
Imax: maximum input current
Ci: maximum internal capacitance
Li: maximum internal inductance

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Figure Connection of CSA NI Devices and Associated Parameters

Parameters of the Device which Gives Energy

Voc: maximum open-circuit output voltage
Maximum voltage that occurs at the open terminal (part) when the Non-Incendive (NI) circuit is open

Isc: maximum short-circuit output current
Maximum current which currents when the NI circuit is short and earth fault

Ca: maximum allowable capacitance
Maximum capacitance that can be connected to the NI circuit

La: maximum allowable inductance
Maximum inductance that can be connected to the NI circuit

Cn: maximum allowable capacitance (in a normal circuit voltage of Vn)
Maximum capacitance that can be connected in a normal circuit voltage of Vn (the circuit current in a state where no opening circuit, short circuit, earth fault occur) in the NI circuit

Vn: normal circuit voltage
Circuit voltage in a state where no opening circuit, short circuit, earth fault occur

Ln: maximum allowable inductance (in a normal circuit current of In)
Maximum inductance which can be connected in a normal circuit voltage of In (the circuit current in a state where no opening circuit, short circuit, earth fault occur) in the NI circuit

In: normal circuit current
Circuit current in a state where no opening circuit, short circuit, earth fault occur

Cc: capacitance of the external wiring

Lc: inductance of the external wiring

Parameters of the Device which Receives Energy

Vmax: maximum input voltage
Maximum voltage that can maintenance the NI properties of the device

Imax: maximum input current
Maximum current that can maintenance the properties of the device

Ci: maximum internal capacitance
Maximum internal capacitance of the device that can be considered to conduct to the NI circuit (the external wiring) when the device is connected to the NI circuit (the external wiring)

Li: maximum internal inductance
Maximum internal inductance of the device that can be considered to conduct to the NI circuit (the external wiring) when the device is connected to the NI circuit (the external wiring)

How to Compare Parameters

It is necessary to compare both parameters of the CENTUM I/O module and the CSA NI device when they are connected.

Comparing parameters between the device which gives energy and the device which receives energy are connected are the following two ways.

In either way to compare, wiring construction should be installed to conform to NEC (National Electrical Code) or the wiring construction standards in the local regions where wiring will be installed.

Installing a Field Wiring in Accordance in a Division 2 Dedicated Wiring Construction

Device that gives energy		Device that receives energy
Vn	≤	Vmax
In	≤	Imax
Cn	≥	summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring
Ln	≥	summation of Li in the device which receives energy + summation of inductance Lc in the external wiring

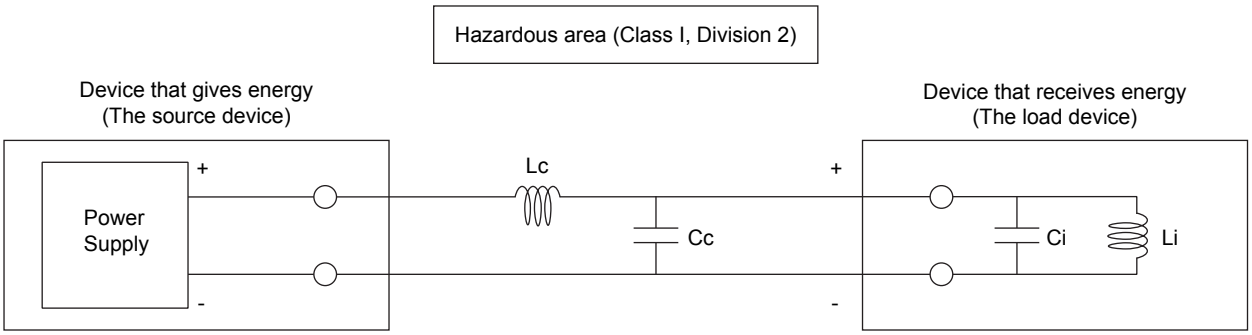
Installing a Field Wiring in Accordance in a General Wiring Construction

Device that gives energy		Device that receives energy
Voc	≤	Vmax
Isc	≤	Imax
Ca	≥	summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring
La	≥	summation of Li in the device which receives energy + summation of inductance Lc in the external wiring

Example

We discuss the case where AAI141 of CENTUM I/O module, a power input module and EJA, a differential pressure transmitter of Yokogawa Electric Corporation are connected.

EJA is connected to the circuit of AAI141 via a 100m cable, and installed in a hazardous area of Class I, Division 2.



<CS 3000 AAI141> <Differential pressure transmitter EJA>

The defined parameters have the following values.

(Voc) = 27.6 V
(Isc) = 27 mA
(Ca) = 0.19 mF
(La) = 2.7 mH
(Cn) = 0.19 mF at (Vn) = 27.6 V
(Ln) = 100 mH at (In) = 24.0 mA
and,
(Cc) = 200 pF/m X 100 m = 0.0002 mF X 100 = 0.02 mF
(Lc) = 0.66 mH/m X 100 m = 0.00066 mH X 100 = 0.066 mH

(Vmax) = 30 V
(Imax) = 165 mA
(Ci) = 0.0225 mF
(Li) = 0.73 mH

therefore,

Voc = 27.6 V	<	Vmax = 30 V
Isc = 27.0 mA	<	Imax = 165 mA
Ca = 0.19 mF	>	Ci + Cc = 0.0425 mF
La = 2.7 mH	>	Li + Lc =0.796 mH

The results above meet the combinational conditions. It can be judged that a field wiring can be installed in accordance with a general wiring construction.

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Figure Connection of AAI141 and EJA

Example of a Connection

Connecting ESB Bus Node Unit and a Device Installed in Division 2

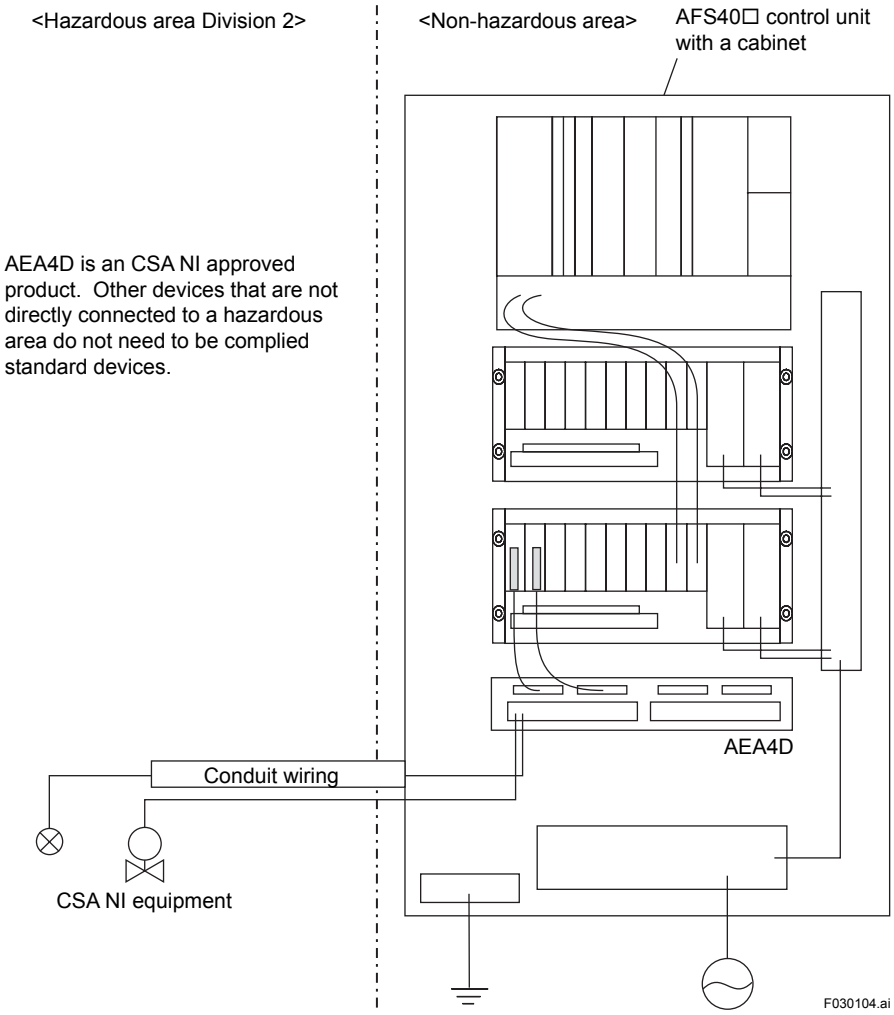

Figure Connecting ESB Bus Node Unit and a Device Installed in Division 2

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, all wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

Installing ER Bus Node Unit in Division 2

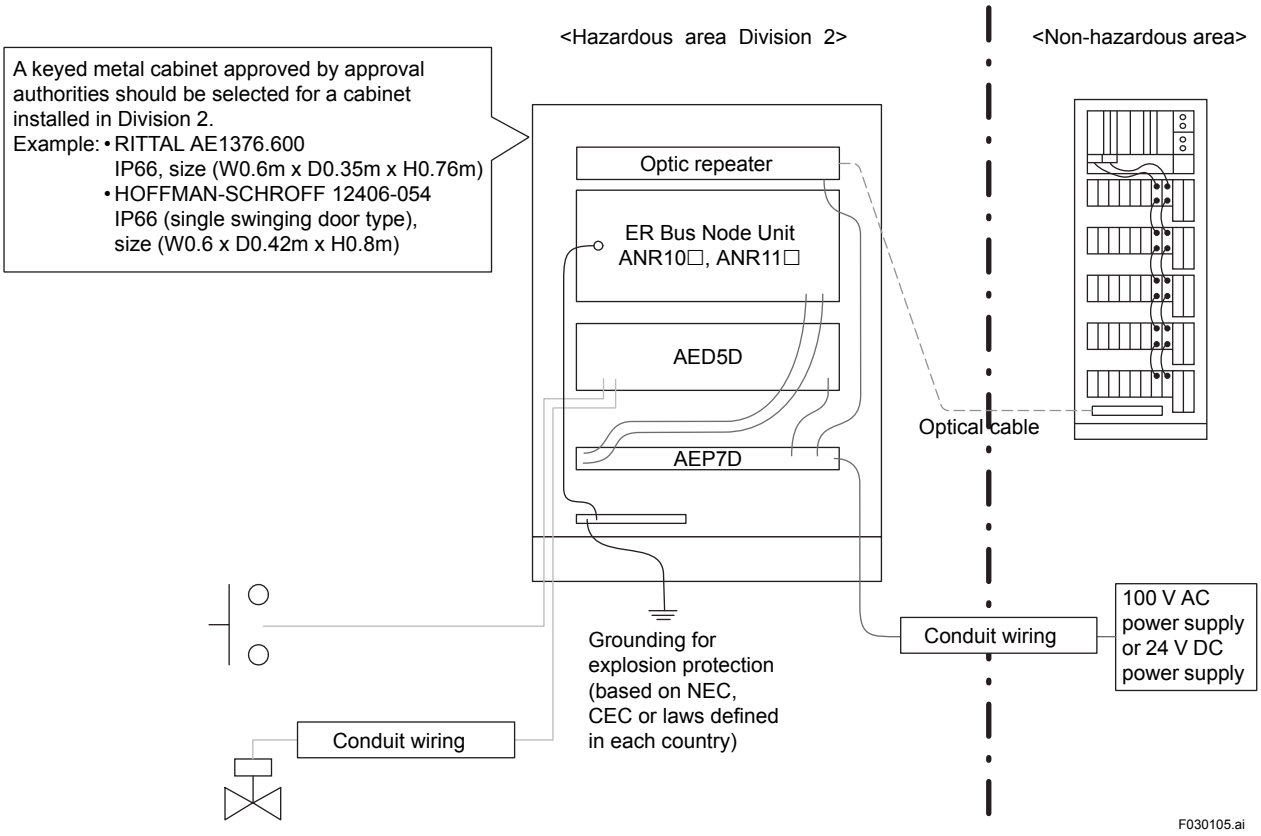
<Hazardous area Division 2>
<Non-hazardous area>
A keyed metal cabinet approved by approval authorities should be selected for a cabinet installed in Division 2.
Example: • RITTAL AE1376.600
IP66, size (W0.6m x D0.35m x H0.76m)
• HOFFMAN-SCHROFF 12406-054
IP66 (single swinging door type), size (W0.6 x D0.42m x H0.8m)
Optic repeater
ER Bus Node Unit
ANR10□, ANR11□
AED5D
AEP7D
Optical cable
Conduit wiring
100 V AC power supply or 24 V DC power supply
Grounding for explosion protection (based on NEC, CEC or laws defined in each country)
Conduit wiring
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Figure Installing ER Bus Node Unit in Division 2

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, all wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Division 2.

Installing Optical ESB Bus Node Unit in Division 2 (Wiring by Optical cable for Optical ESB Bus)

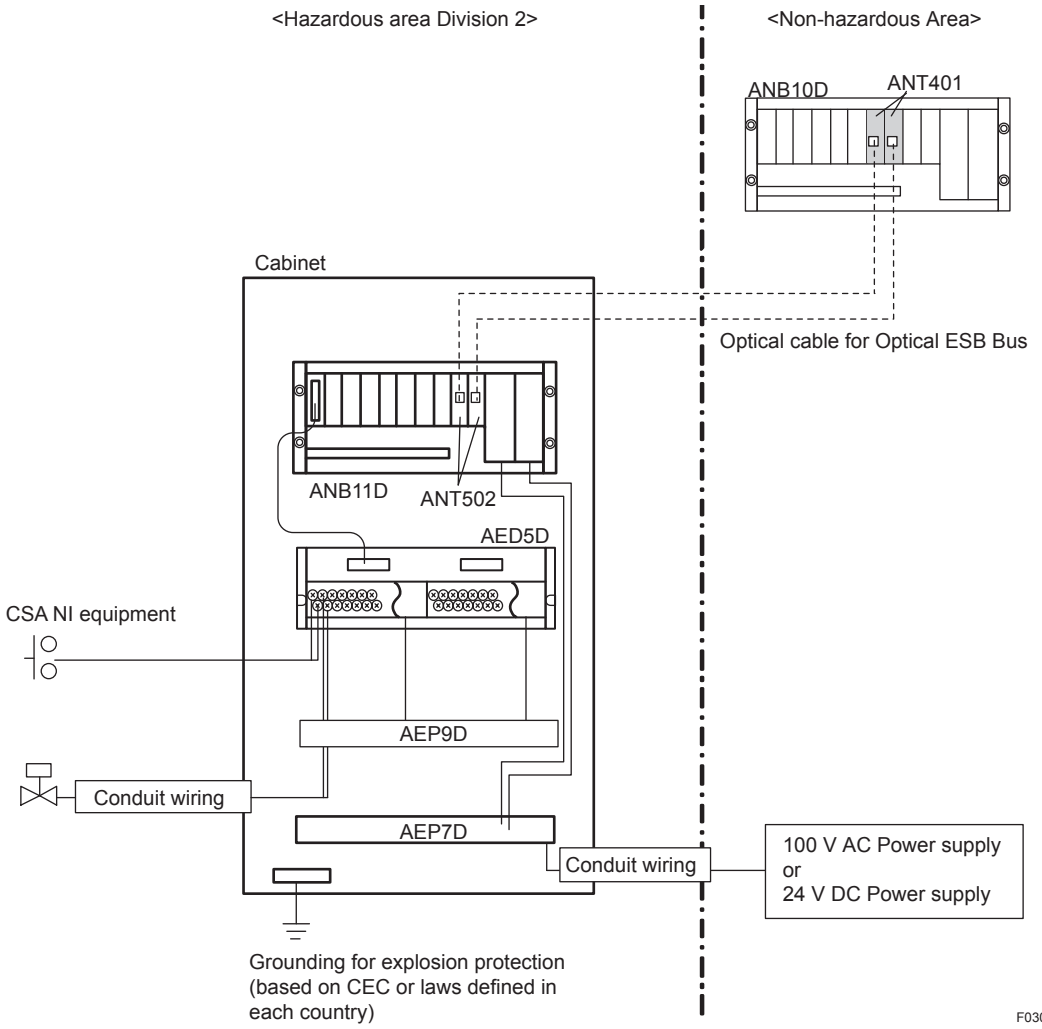


Figure Installing Optical ESB Bus Node Unit in Division 2 (Wiring by Optical cable for Optical ESB Bus)

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, all wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

3.1.2 FM NI (FM Nonincendive)

A Field Control Unit (for Vnet/IP), a node unit for FIO and an I/O module of CENTUM have acquired NI of Factory Mutual (FM) safety certification.

This approval permit that the products above can be used in hazardous areas such as Class I and Division 2 and that the I/O module can be directly connected to an FM NI approved field device installed in hazardous areas such as Class I and Division 2.

In addition, an I/O modules installed in non-hazardous areas can be directly connected to an FM NI approved field device installed in hazardous areas such as Class I and Division 2.

Complied Standards

Class I,Division2,GroupsA,B,CandDTemperature code T4

Class 3600:2011

Class 3611:2004

Class 3810:2005

(for 100-120 V AC, 220-240VAC, and 24 V DC power supply)

FM NI Approved Products and Their Configuration Example

The figure below is an example of the configuration of FM NI approved products that can be installed in hazardous areas. See the table “The List of FM NI Compliant Products” in Appendix for details.

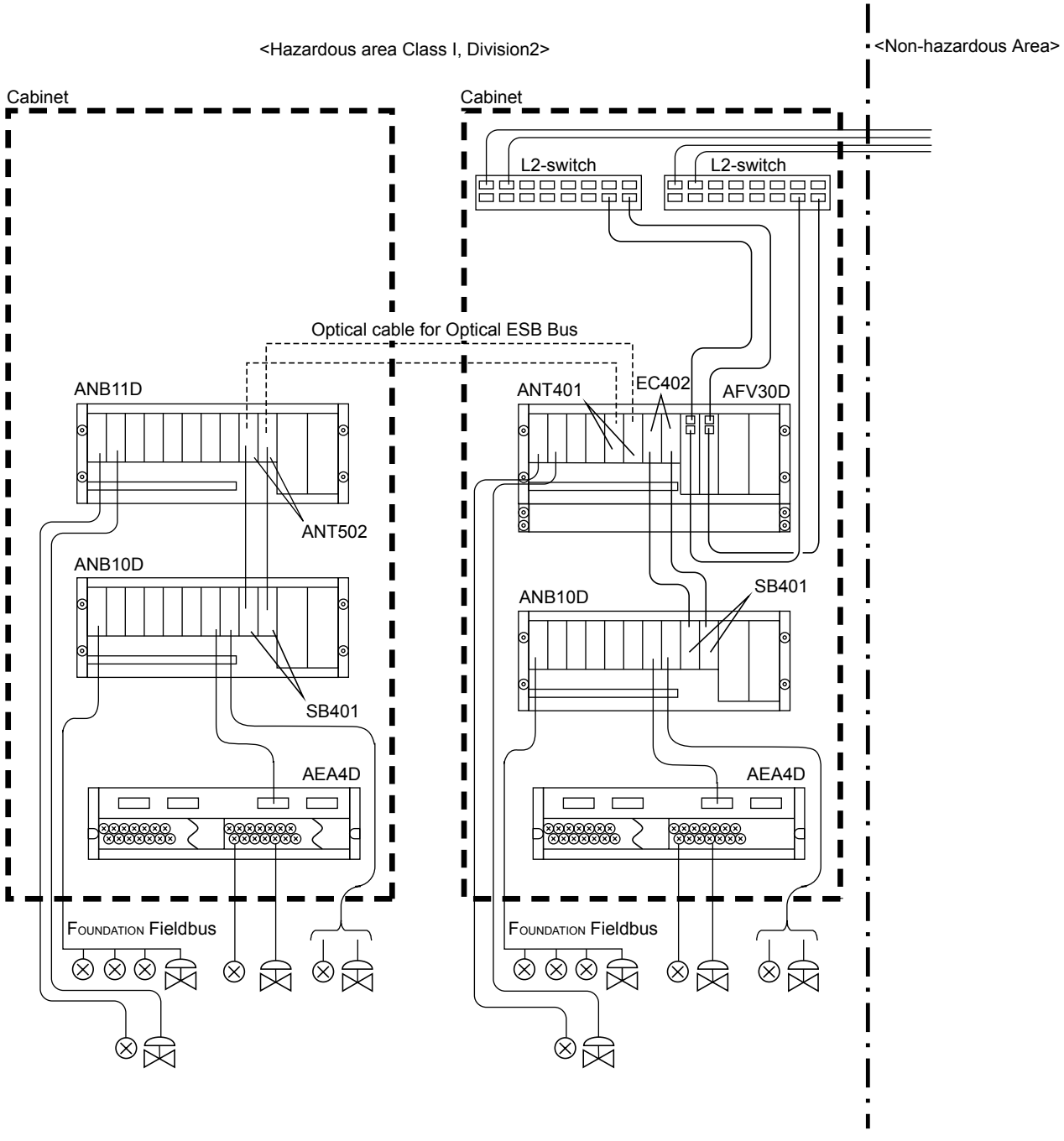


Figure Example of the configuration of FM NI approved products

Device Installation

- Devices must be installed by professionally trained personnel.
- Install devices according to NEC (National Electrical Code: ANSI/NFPA-70).
- When devices are installed in a hazardous area in Class I, Division2, put them in a metal cabinet with a key compliant with FM class 3810 and FM class 3600, or the one approved by FM or a local testing institution.
  When the devices to be connected to field devices in a hazardous area are installed in non-hazardous area, put them in a metal cabinet conforming to FM class 3810.
- Please refer to the related GS (General Specifications), “Installation Guidance” TI33Q01J10-01E and “Installation Guidance (for Vnet/IP)” TI33P01J10-01E.

- Precautions on device use
  - Cabinet door must be closed when devices are used.
  - Empty slots in a cabinet must be covered by a dedicated cover.
  - Each cable in a cabinet must be fixed.
  - A breaker to cut power supply must be installed in non-hazardous area so that power supply to the devices is cut under abnormal circumstances.

Maintenance

- Devices must be installed by professionally trained personnel or ask Yokogawa’s service office. If devices are installed by person other than those above, FM NI approved products will be invalid.
- Do not perform maintenance on running devices installed in a hazardous area in Class I, Division 2.
  Disconnect modules and terminals installed in a hazardous area in Class I, Division 2 only for installation or maintenance.
- Initial and regular maintenance are also done by professionally trained personnel according to IEC 60079-17.

Wiring

- Devices must be wired by professionally trained personnel.
- Install explosion-proof wiring defined in NEC (National Electrical Code: ANSI/NFPA-70) or the code in the relevant country to wire devices with no indication of electrical parameters. Wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in the relevant country.

Power Supply Wiring

When field control unit (for Vnet/IP), node unit for FIO, power distribution unit and power supply module are installed in a hazardous area in Class I, Division 2, wire a power supply cable from a non-hazardous area by explosion-proof wiring (including metal conduit wiring).

When AED5D and A1BD5D are combined with ADV151, ADV161, ADV551 and ADV561, install an explosion-proof wiring defined in the relevant country for the wiring outside of the external power supply cable cabinet.

Signal Wiring

When an optical cable is installed in Class I, Division 2, general wiring defined in the relevant country is available. Optical cable does not emit energy to cause air explosion.

Install explosion-proof wiring defined in the relevant country for the following signal wiring:

- Wiring contact output terminals of field control unit outside of a cabinet
- Wiring Vnet/IP cable and ESB bus cable outside of a cabinet
- Wiring ER bus cable to be connected to EB402 and EB511 outside of a cabinet
- Wiring AAP135 outside of a cabinet when it is used as the source device (*1)
  General wiring defined in the relevant country can be installed according to the indicated electrical parameters for signal wiring of AAP135 outside of a cabinet when it is used as the load device (*1).
- Use DC power supply compliant with the Standard for Explosion Protection for combination of ADV151 and AED5D or A1BD5D, or that of ADV161 and AED5D or A1BD5D in contact input mode and voltage input mode. Connection according to the parameters of this power supply makes signal wiring outside of the cabinet compliant with the local standard. Please read the instruction on contact input mode wiring and the instruction on voltage input mode when you actually install wiring.
- Wiring outside of a cabinet in voltage output mode by a combination of ADV551 and AED5D or A1BD5D, or ADV561 and AED5D or A1BD5D.
  Wiring contact output mode outside of a cabinet according to the indicated electrical parameters is compliant with the local standard.
- Wiring outside of a cabinet to ALR111, ALR121 or ALE111.
- Wiring outside of a cabinet to ALF111
  When a barrier for field bus available in Class I, Division 2 is mounted in the same cabinet and connected, wiring to the field devices outside of the cabinet can be a general wiring defined in the relevant country.

*1: AAP135 is “the source device” in case of voltage-free contact input and voltage pulse input (when connected to signal names IN□B and IN□C). In other connections, it is “the load device.”

Precaution

Please observe the following precautions while product is operating or under maintenance service.

WARNING

EXPOSURE TO SOME CHEMICALS MAY DEGRADE THE SEALING PROPERTIES OF MATERIALS USED IN THE FOLLOWING DEVICES; AFV10☐ and AFV30☐.

WARNING

EXPLOSION HAZARD. DO NOT REMOVE OR REPLACE LAMPS OR FUSES UNLESS POWER HAS BEEN DISCONNECTED OR WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

WARNING

EXPLOSION HAZARD. DO NOT DISCONNECT EQUIPMENT WHEN A FLAMMBLE OR COMBUSTBLE ATMOSPHERE IS PRESENT.

WARNING

EXPLOSION HAZARD. DO NOT OPEN ENCLOSURE OR REPLACE BATTERY WHEN A FLAMMABLE OR COMBUSTIBLE ATMOSPHERE IS PRESENT.

Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.
Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

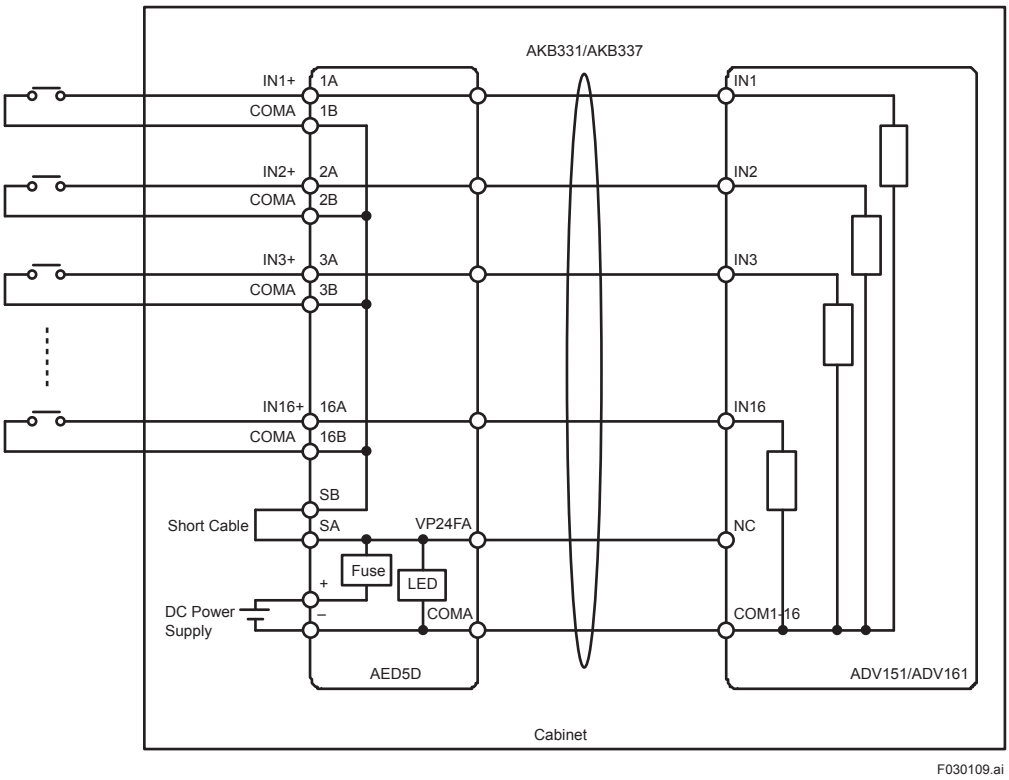


Figure Connection example of ADV151/ADV161 Contact Input Mode

Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

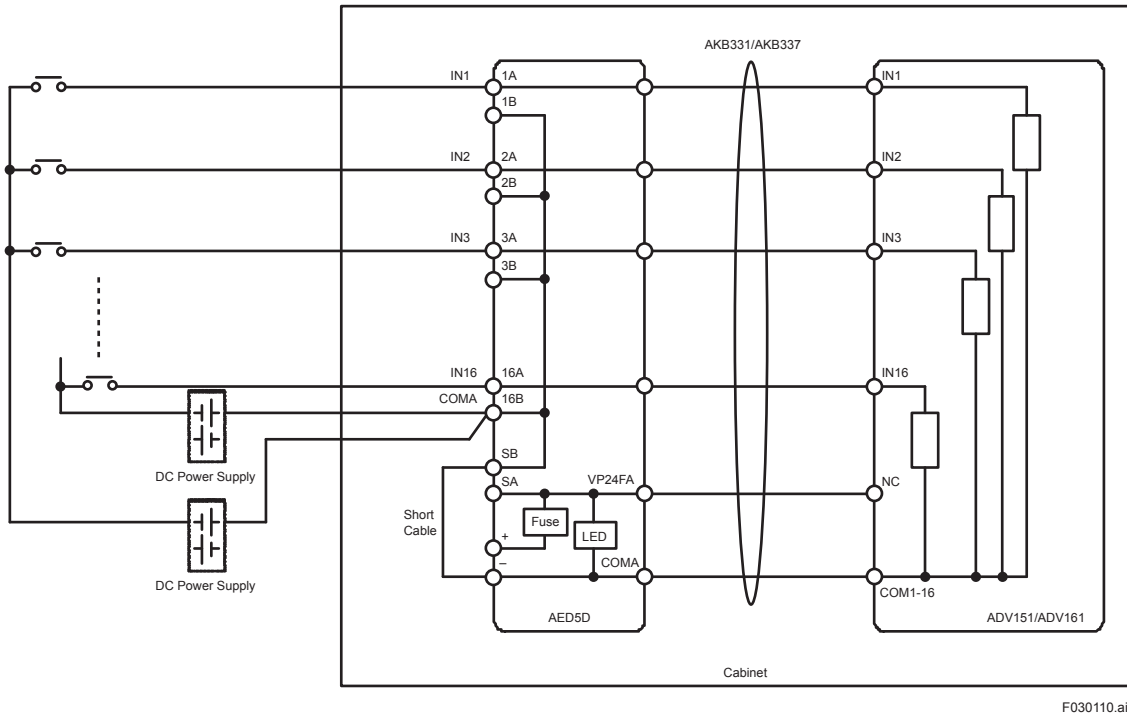
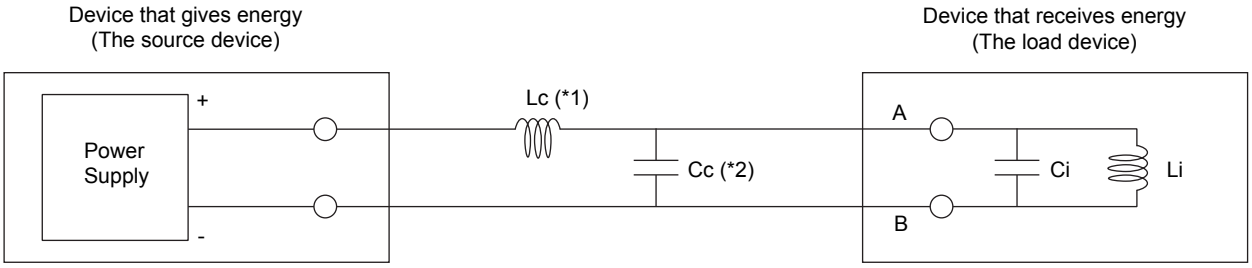


Figure Connection example of ADV151/ADV161 Voltage Input Mode

Parameters in Connection with FM NI Devices

Energy transfer influences FM NI properties. In order to maintain these properties, parameters must be displayed when FM NI devices are connected.

To display parameters, FM NI devices are divided into the device that gives energy and the device that receives energy.



Displayed parameters
Voc: maximum open-circuit output voltage
Isc: maximum short-circuit output current
Ca: maximum allowable capacitance
La: maximum allowable inductance

*1: Lc: inductance of the external wiring
*2: Cc: capacitance of the external wiring

Displayed parameters
Vmax: maximum input voltage
Imax: maximum input current
Ci: maximum internal capacitance
Li: maximum internal inductance

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Figure Connection of FM NI Devices and Associated Parameters

How to Compare Parameters

How to compare parameters when the device that gives energy and the device that receives energy are connected is in the following. If the parameters satisfy the following formulas, a FM NI explosion-proof device can be connected in a general wiring. Otherwise, the wiring should be installed to conform to NEC (National Electrical Code: ANSI/NFPA-70) or an explosion-proof wiring defined in the relevant country.

Device that gives energy		Device that receives energy
Voc	≤	Vmax
Isc	≤	Imax
Ca	≥	summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring
La	≥	summation of Li in the device which receives energy + summation of inductance Lc in the external wiring

Example of a Connection

Connecting ESB Bus Node Unit and a Device Installed in Class I, Division 2

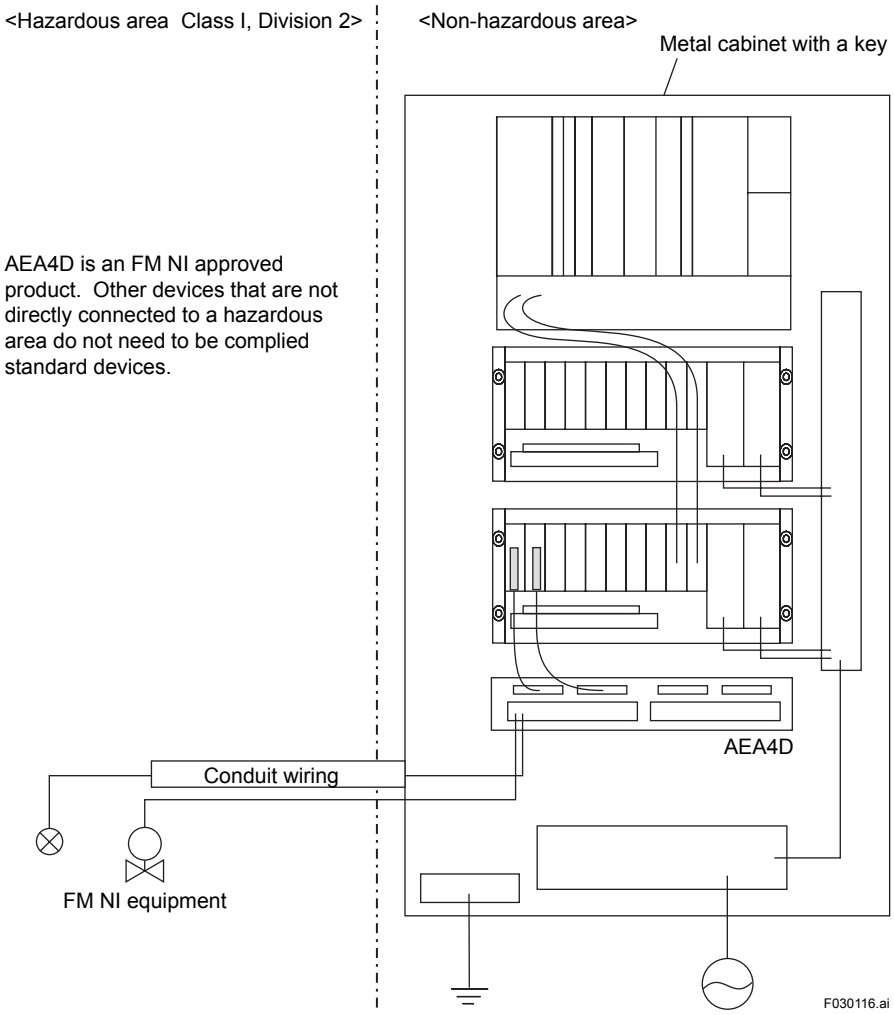


Figure Connecting ESB Bus Node Unit and a Device Installed in Class I, Division 2

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

Installing ER Bus Node Unit in Class I, Division 2 (Wiring by ER Bus)

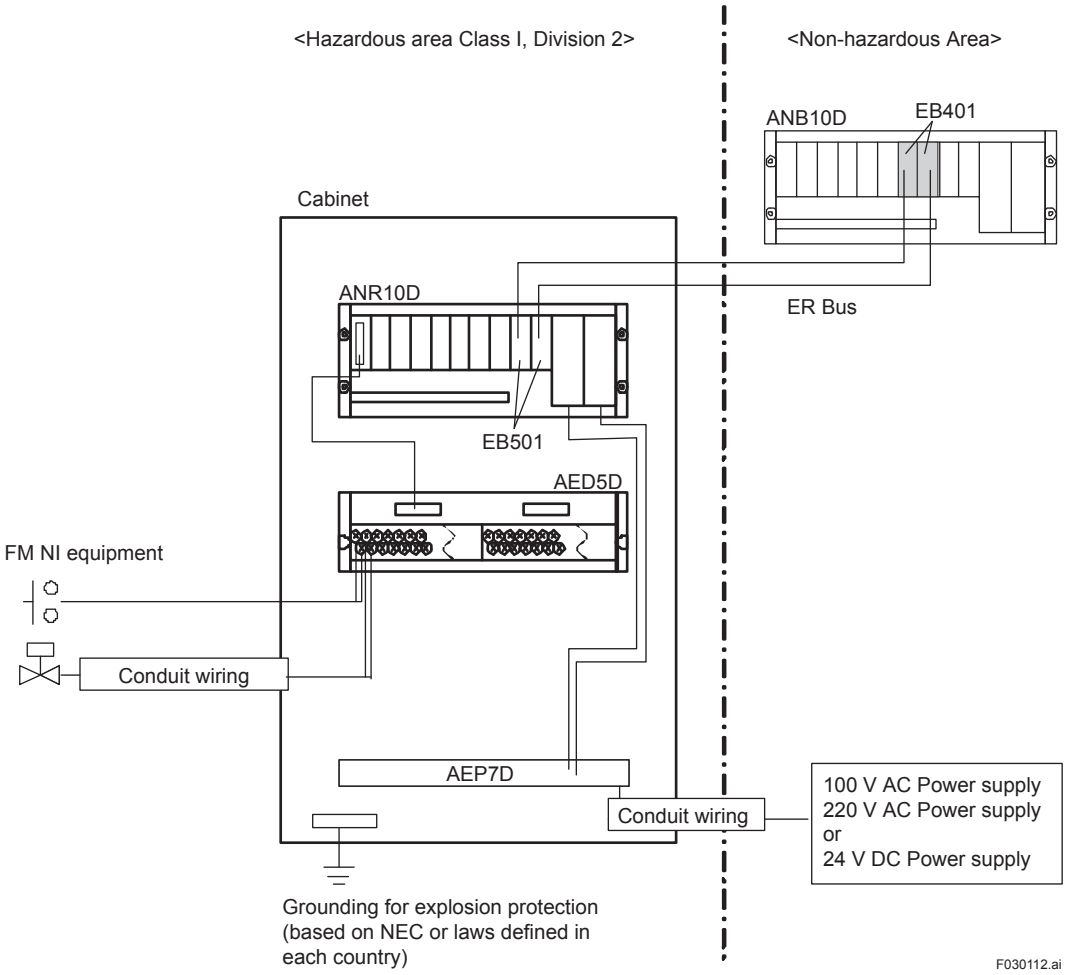


Figure Installing ER Bus Node Unit in Class I, Division 2 (Wiring by ER Bus)

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

Installing ER Bus Node Unit in Class I, Division 2 (Wiring by Optical cable for ER Bus)

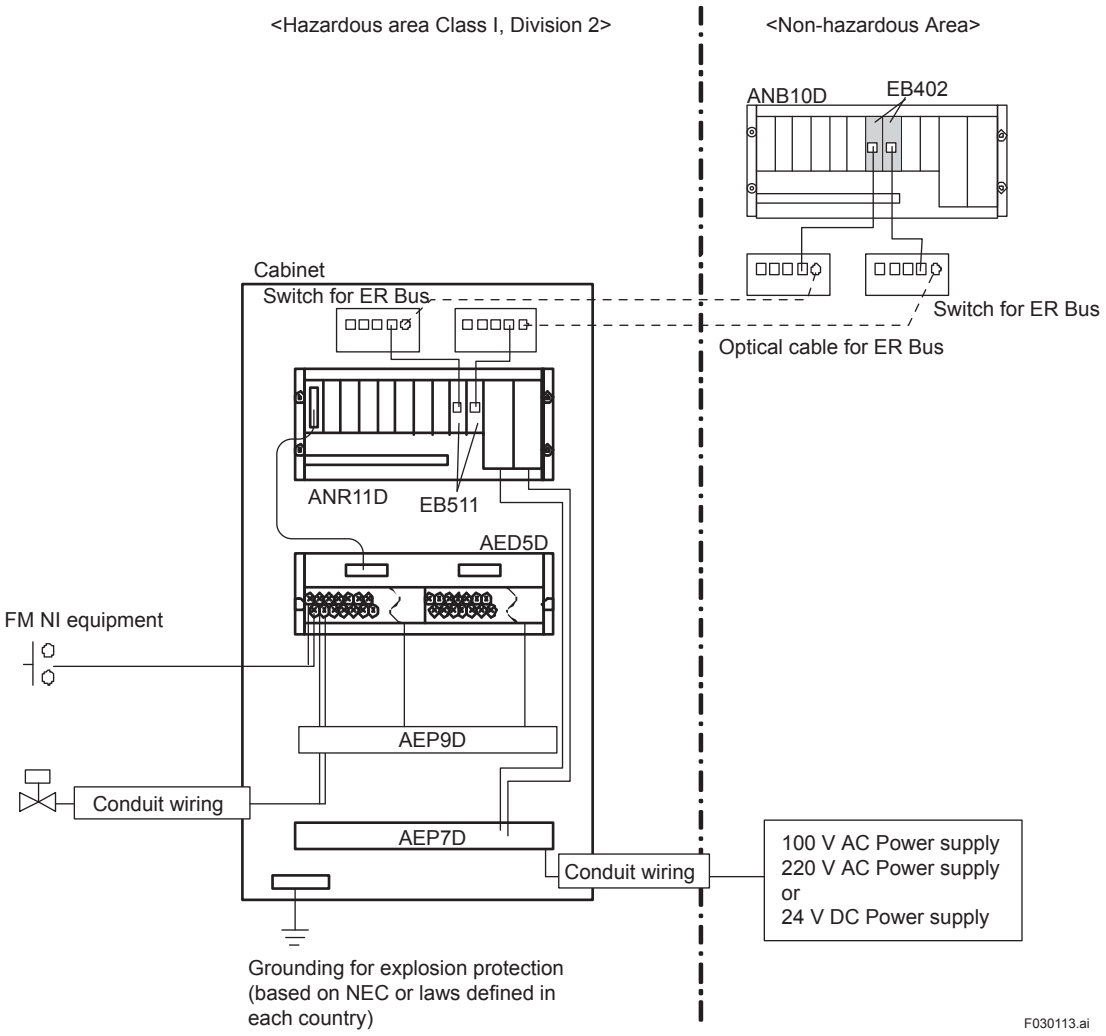


Figure Installing ER Bus Node Unit in Class I, Division 2 (Wiring by Optical cable for ER Bus)

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- Use ER bus switch (Network Devices) which can be installed in a hazardous area in Class I, Division 2.

Installing Optical ESB Bus Node Unit in Class I, Division 2 (Wiring by Optical cable for Optical ESB Bus)

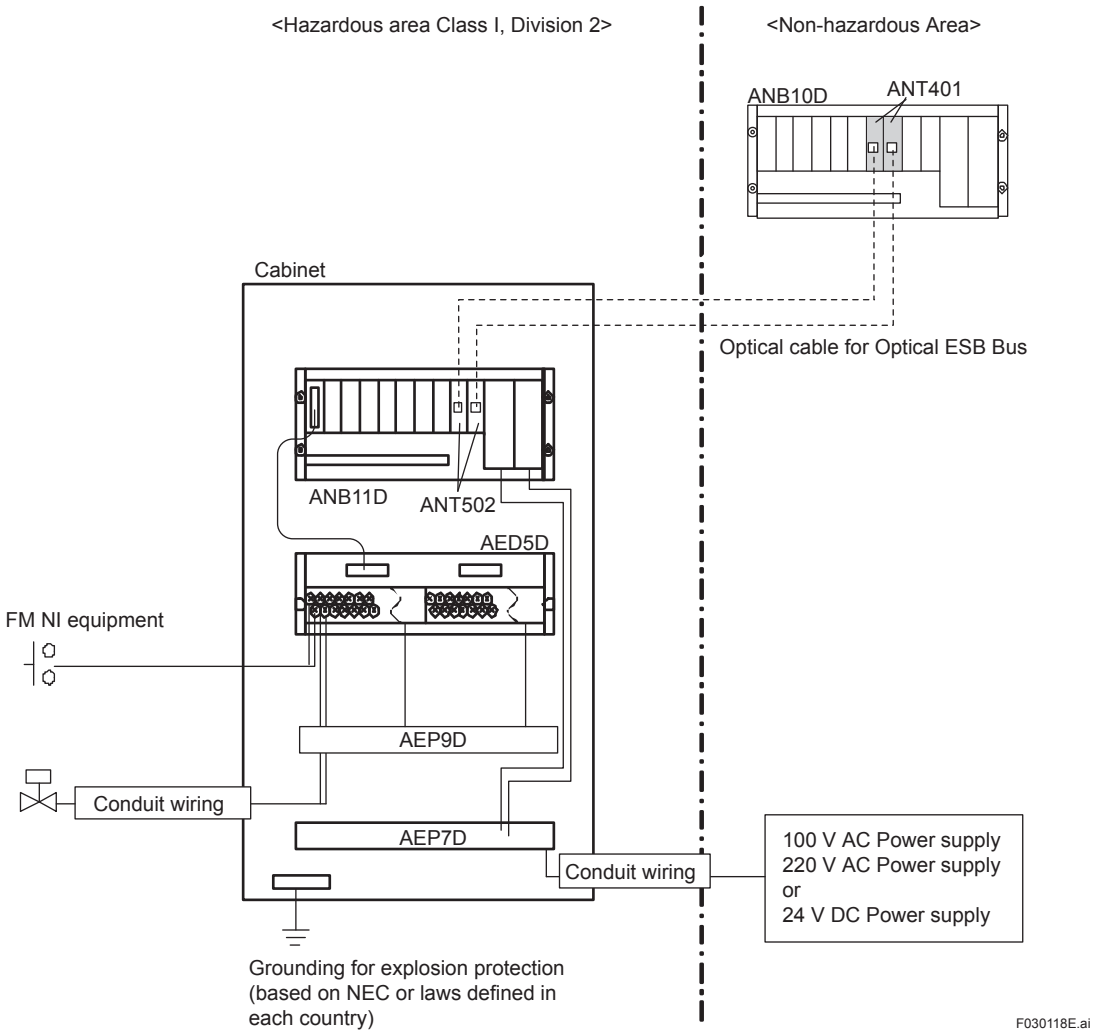


Figure Installing Optical ESB Bus Node Unit in Class I, Division 2 (Wiring by Optical cable for Optical ESB Bus)

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.

Installing a FCS or ESB Bus Node Unit in Class I, Division 2

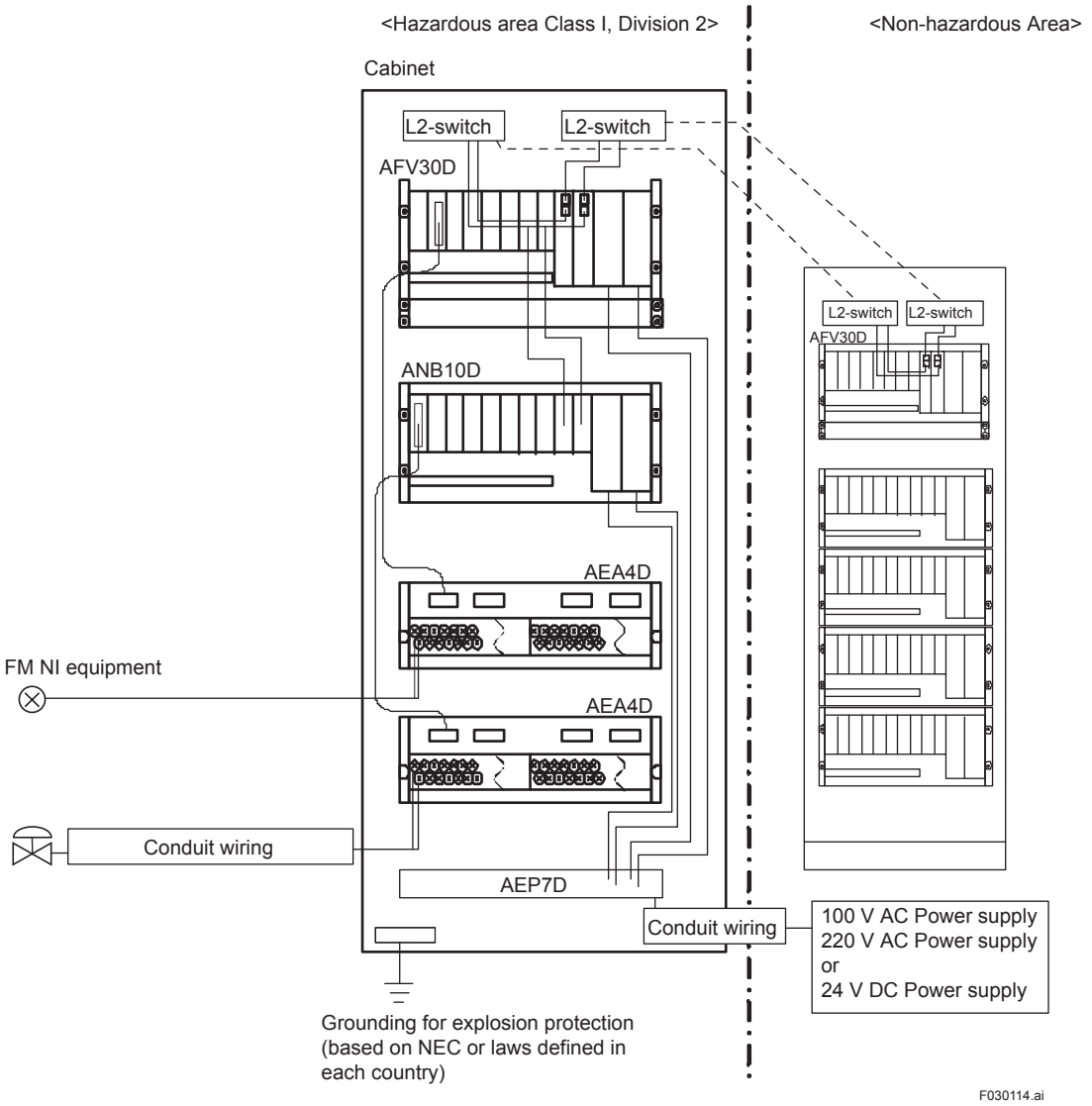


Figure Installing a FCS or ESB Bus Node Unit in Class I, Division 2

- To connect with a field device, electrical parameters of each device should be met.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (including threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country. In addition, wiring the devices that indicate electrical parameters with the compliant devices can be a general wiring defined in each country.
- Use L2 switch (Network Devices) which can be installed in a hazardous area in Class I, Division 2.

3.2 Type “n”

Type “n” is a construction that enhances safety not to cause a spark, an arc or high surface temperatures in a normal operation and also to avoid causing a spark, an arc or high surface temperatures under defined conditions such as an overload.

A Field Control Unit (for Vnet/IP), a node unit for FIO and an I/O module of CENTUM have acquired Type “n” of European standards.

This approval permits that the products above can be used in hazardous areas such as Zone 2.

Complied Standards

[Explosion-proof specifications]
II 3 G Ex nA IIC T4 Gc X (*1)
II 3 G Ex nA nC IIC T4 Gc X (*2)

[Complied standard]
EN 60079-0:2012
EN 60079-15:2010
(for 24 V DC power supply)

*1: Applied for products complied with Type “n”, except for AFV10S, AFV10D, AFV30S, AFV30D, and A1BD5D.
*2: Applied for the below products.
AFV10S, AFV10D, AFV30S, AFV30D, and A1BD5D

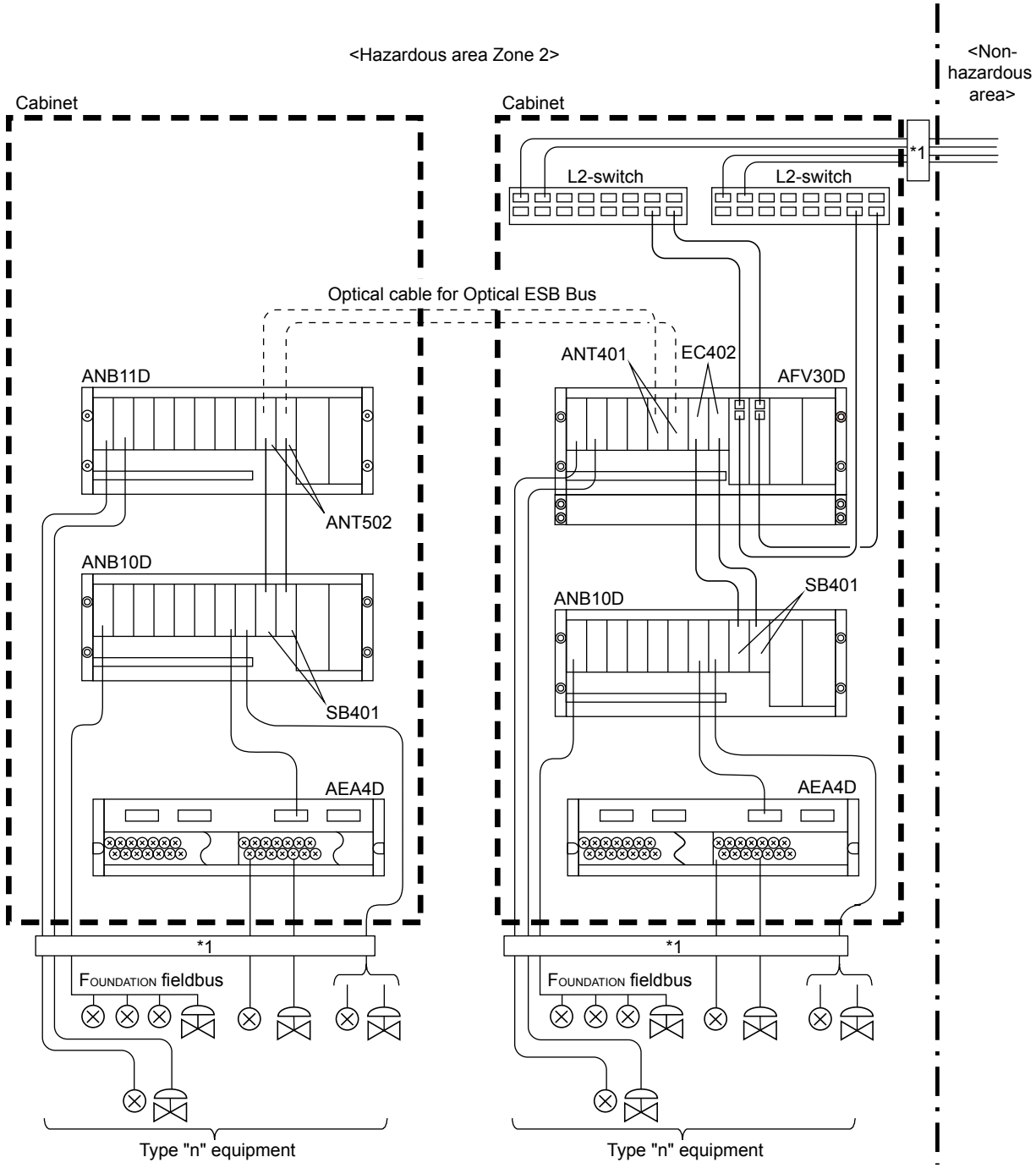
[Explosion-proof specifications]
II 3 G EEx nA II T4 X (*1)

[Complied standard]
EN 50021:1999
(for 24 V DC power supply)

*1: Applied for the below products.
ASI133, ASI533, AST143, ASR133, ASD143, and ASD533

Type “n” Approved Products and Their Configuration Example

The figure below is an example of the configuration of Type “n” compliant products that can be installed in hazardous areas. See the table “The List of Type “n” Compliant Products” described in Appendix for detail.



*1: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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Figure Example of the configuration of Type “n” approved products

Precautions

Specific conditions of use

- When the equipment are located in hazardous areas, they shall be installed in metal cabinets with locks and keys which provides a degree of protection not less than IP54 in accordance with IEC 60529.
- The equipment shall be accordingly located in areas of not more than pollution degree 2 (defined in IEC 60664-1) to prevent adverse environmental conditions caused by foreign solid particles, dust and water etc.
- The equipment shall be used within -10 %/+10 % of specified input 24 V DC with including ripple at the power supply terminals.

Installation

- The equipment shall be installed and used within their ratings and electrical parameters.
- All equipment and wiring in hazardous areas shall be installed in accordance with EN 60079-14 and related local electrical codes and the installation shall also comply with the appropriate requirements for non-hazardous areas.
- Instructions provided in GS (General specifications), TI (Technical Information of Installation Guidance) and/or IM (User's Manuals) shall be observed.
- The installation shall be carried out only by qualified personnel whose training has included instruction on the type of protection and installation practices, relevant rules and regulations and general principles of area classification.
- The degree of protection not less than IP54 shall be maintained at cable entries into the cabinet.
- It must be observed during the installation that the venting slots of the equipment are not blocked off by cable parts, fixing accessories etc.
- Screws of terminals for field wiring connections shall be tightened with specified torque values.
- On completion of the installation and prior to first use, initial inspection of the equipment and installation shall be carried out in accordance with EN 60079-17.
- Abide by the following guidance so as to ensure the safety and performance.
  - Make sure that all the empty slots in the cabinet should be properly covered with attached caps.
  - Make sure that all the cables are rigidly fixed in the cabinet.

Maintenance and Repair

- Inspections and maintenance of the equipment and installations shall be carried out only by qualified personnel and in accordance with EN 60079-17.
- Repair, overhaul, reclamation of the equipment shall be carried out only by qualified personnel and in accordance with EN 60079-19.
- Repairs of the equipment shall be carried out only by trained, experienced, skilled, knowledgeable and/or supervised personnel, or by the service engineers recognized by Yokogawa. Otherwise, the type of protection may be invalidated.
- Modifications shall not be made to the equipment which are operated in hazardous areas.

WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,
DO NOT OPEN THE CABINET WHILE THE EQUIPMENT ARE ENERGIZED.

WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,
DO NOT REMOVE OR REPLACE THE FUSE WHEN ENERGIZED.

WARNING

WHEN AN EXPLOSIVE ATMOSPHERE IS PRESENT,
DO NOT SEPARATE THE CONNECTIONS WHEN ENERGIZED.

Instruction on Contact Input Mode Wiring

When the number of channels is limited because power supply exceeds its capacity, but parallel connection for the purpose of increasing capacity is not allowed.

Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.

When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

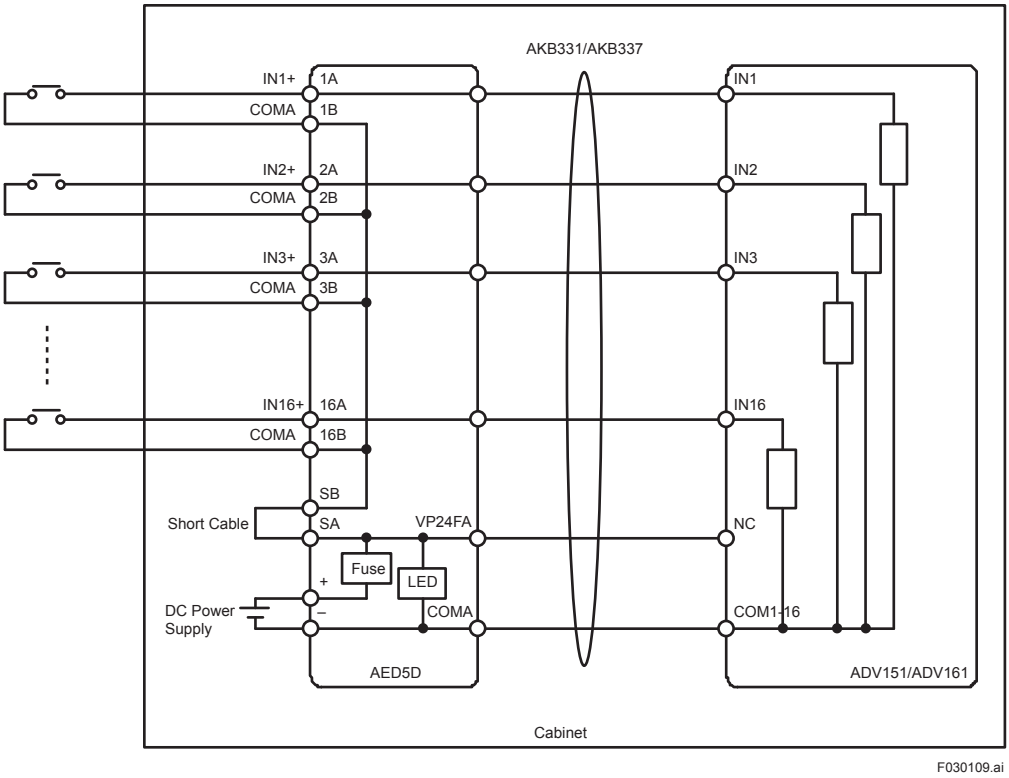


Figure Connection example of ADV151/ADV161 Contact Input Mode

Instruction on Voltage Input Mode Wiring

The total current value of the channels must be within the rated current (limit) for DC power supply.
But if the total current value exceeds the rated current, reduce the number of channels to be supplied at on time, and prepare the same DC power supply for each channel group.
In such a case, the polarity of power sources should be the same.
Mount ADV151, ADV161, AED5D, A1BD5D, AKB331 and AKB337 in the same cabinet.
When ADV151 or ADV161 is mounted in a cabinet different from that for AED5D or A1BD5D, apply explosion-proof wiring defined in each country for AKB331 or AKB337.

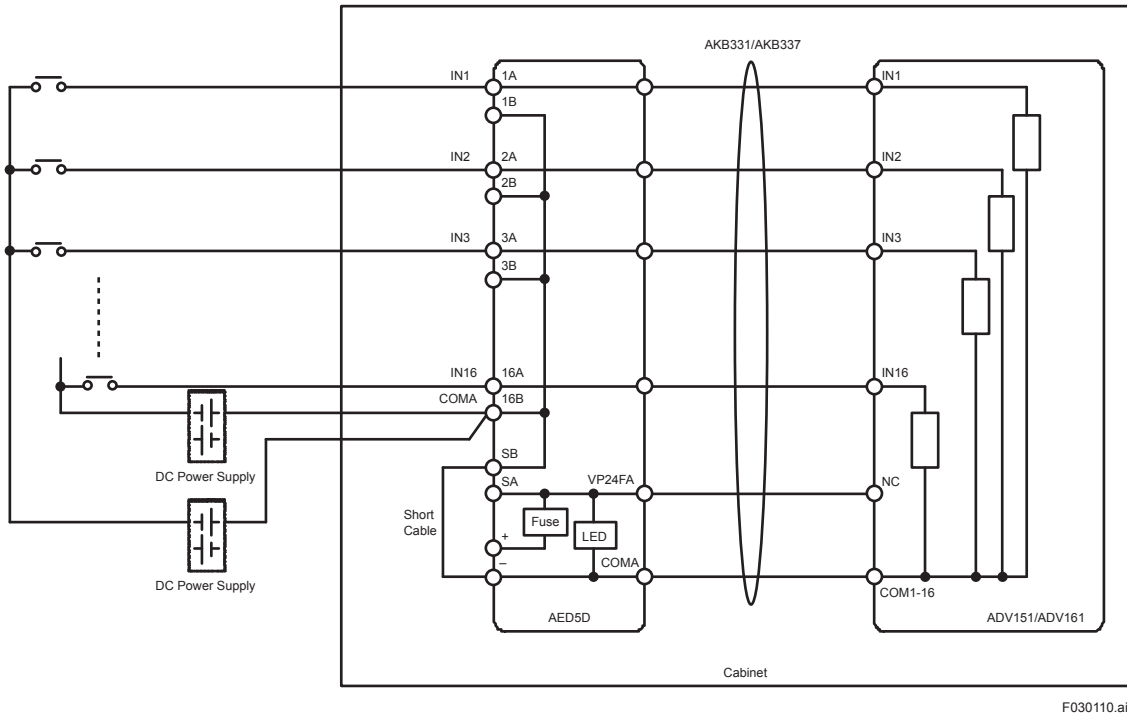
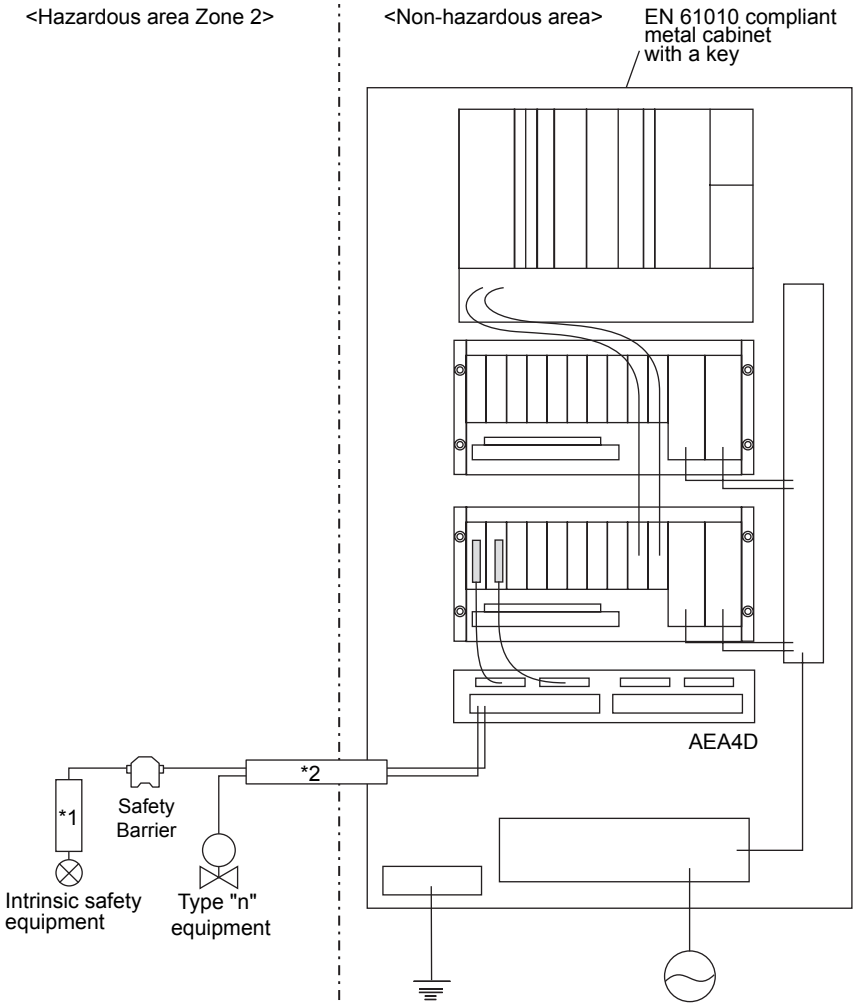


Figure Connection example of ADV151/ADV161 Voltage Input Mode

Example of a Connection

Connecting ESB Bus Node Unit and a Device Installed in Zone 2



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region
*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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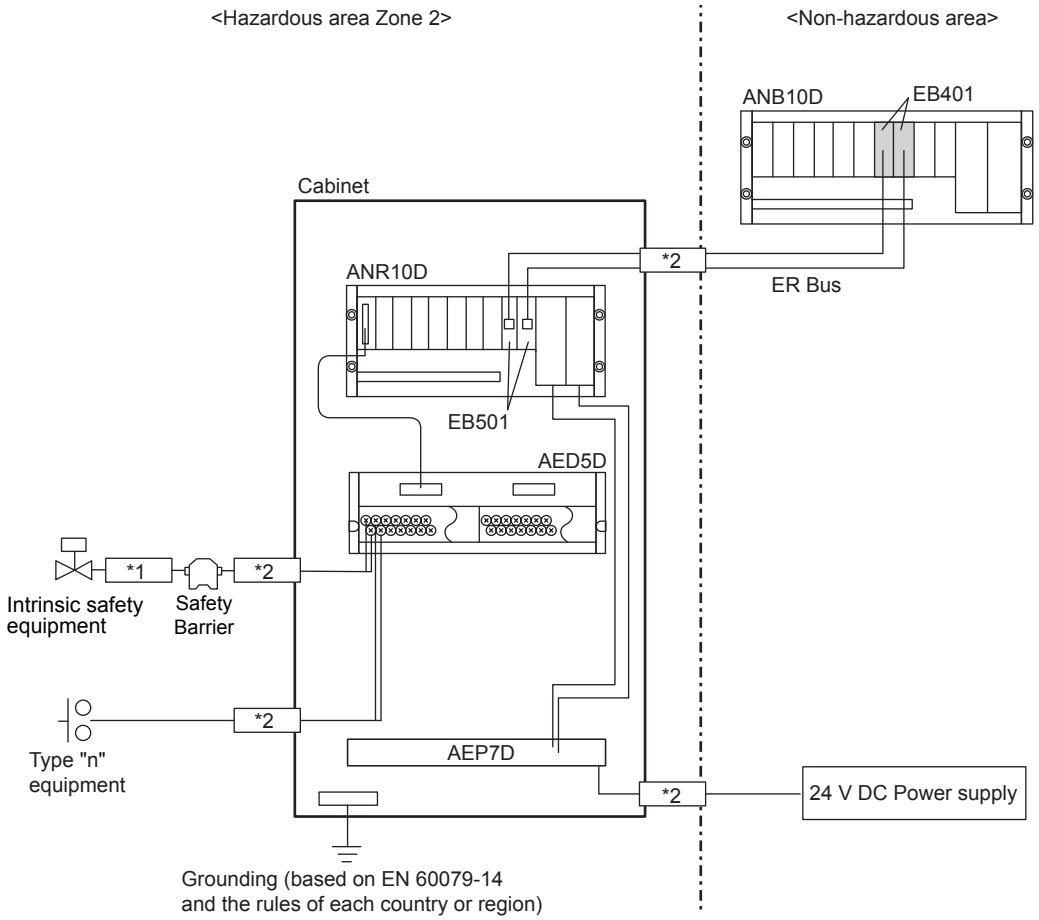
Figure Connecting ESB Bus Node Unit and a Device Installed in Zone 2

Installing ER Bus Node Unit in Zone 2 (Wiring by ER Bus)



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region

*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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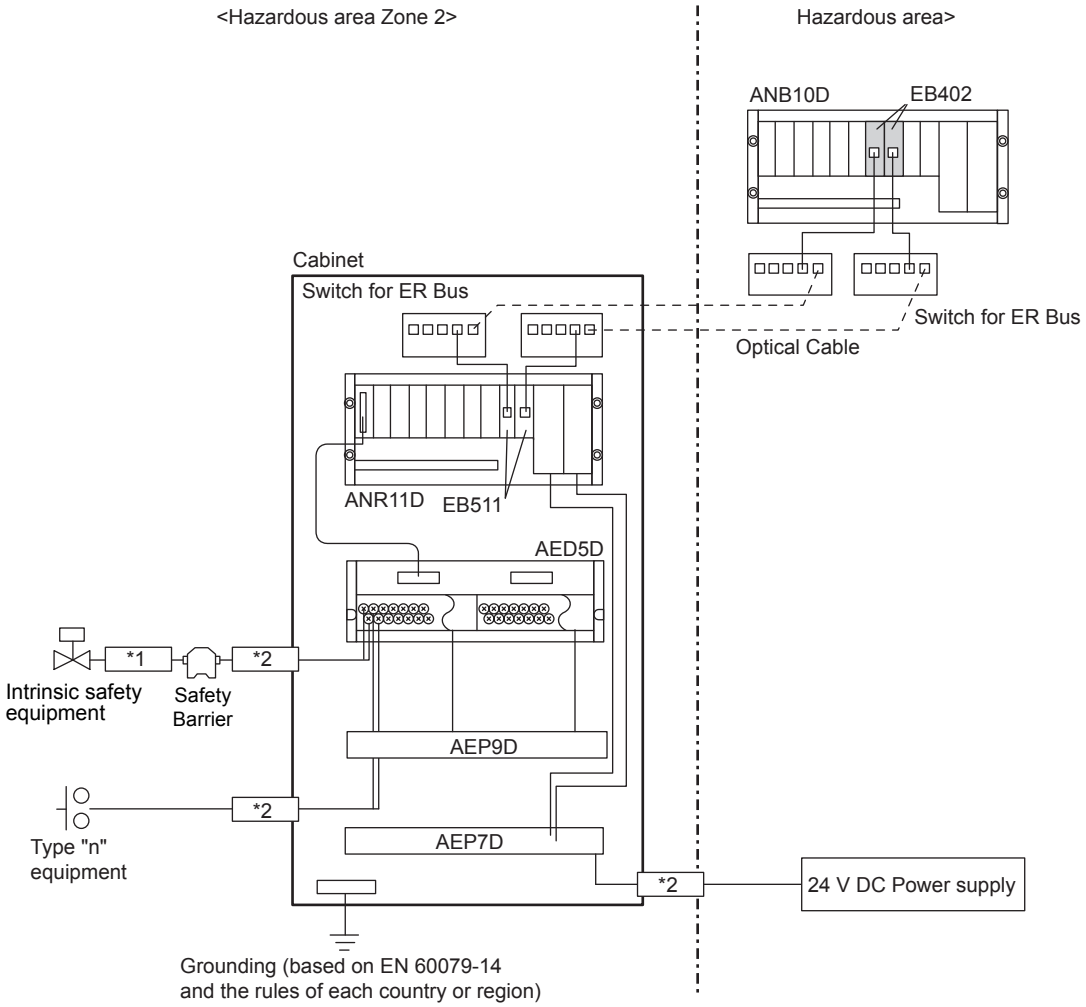
Figure Installing ER Bus Node Unit in Zone 2 (Wiring by ER Bus)

Installing ER Bus Node Unit in Zone 2 (Wiring by Optical cable for ER Bus)



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region

*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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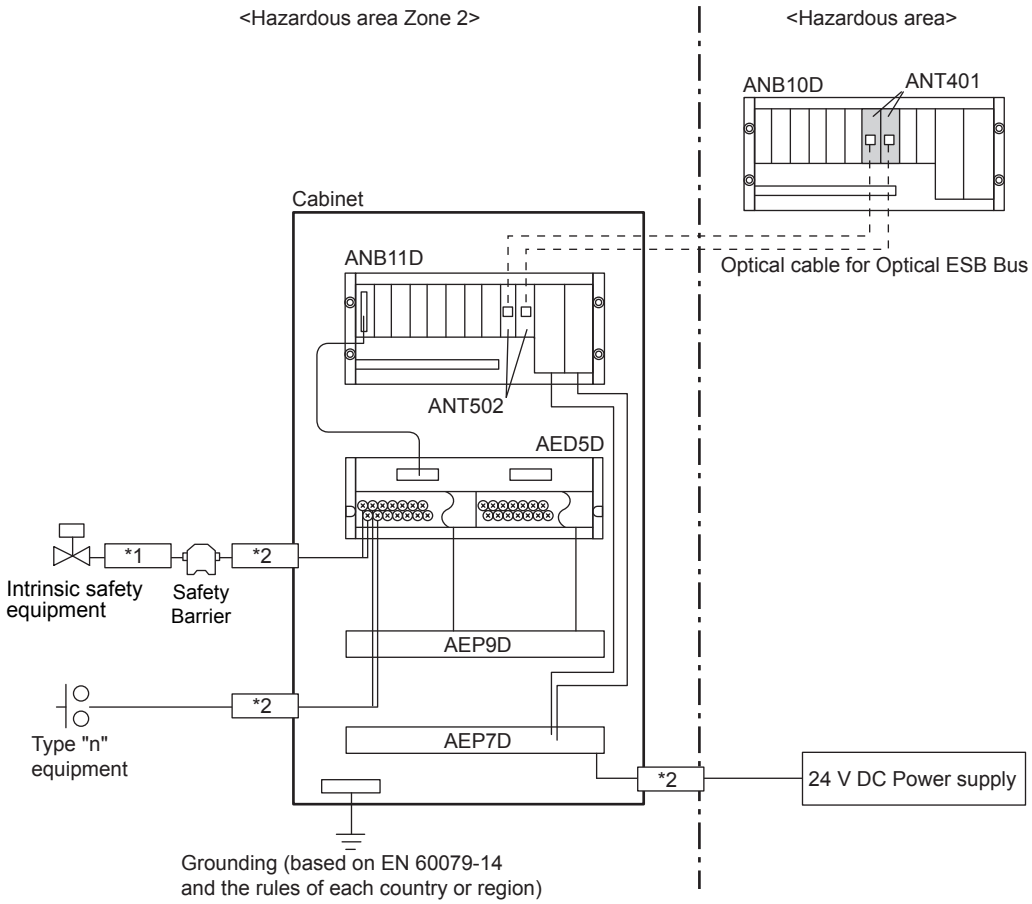
Figure Installing ER Bus Node Unit in Zone 2 (Wiring by Optical cable for ER Bus)

Installing Optical ESB Bus Node Unit in Zone 2 (Wiring by Optical cable for Optical ESB Bus)



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region
*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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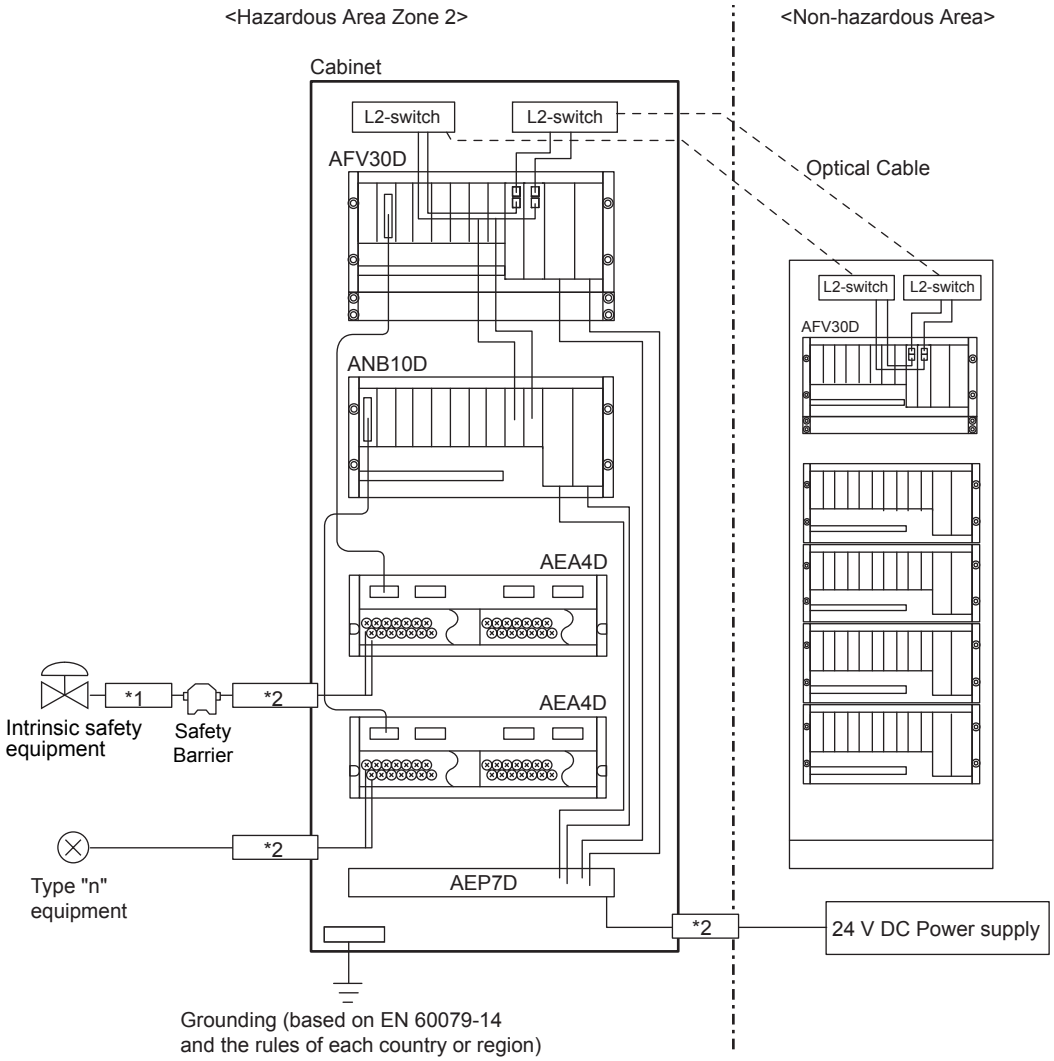
Figure Installing Optical ESB Bus Node Unit in Zone 2 (Wiring by Optical cable for Optical ESB Bus)

Installing a FCS or ESB Bus Node Unit in Zone 2



*1: Explosion-proof wiring for intrinsically safe circuits that is defined in EN 60079-14, EN 60079-25 and the rules/standards of each country or region

*2: Explosion-proof wiring for Type"n" equipment that is defined in EN 60079-14 and the rules/standards of each country or region

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Figure Installing a FCS or ESB Bus Node Unit in Zone 2

4. Intrinsic Safety Explosion Protection Instrumentation

Intrinsic safety explosion protection is an electric circuit and a construction, which made so as not to ignite to gas by controlling the energy of electric circuit, if sparks, arc, and heat occur at the time of normal operating and an accident (short-circuit, earth fault, burnout). Intrinsic safety explosion protection equipments include intrinsic safety equipments and equipments related with intrinsic safety. Intrinsic safety equipments are able to be used in hazardous area. Equipments related with intrinsic safety are set up in non-hazardous area, and is connected with intrinsic safety equipment.

In CENTUM, module with built-in barrier is available as equipments related with intrinsic safety. Also, intrinsic safety explosion protection instrumentation can be done by building Zener barrier or insulating barrier into it.

4.1 Intrinsic Safety Explosion Protection Instrumentation Using Module with Built-in Barrier

4.1.1 Intrinsic Safety Explosion Protection of ATEX Standard

Modules with Built-in Barrier

The module with built-in barrier in CENTUM is equipment related with intrinsic safety, and a construction of explosion protection is implemented, by combination with intrinsic safety equipment placed in hazardous area. The module with built-in barrier eliminates the need for another barrier to connect with the equipment placed in Zone 0, Zone 1 and Zone 2. Moreover, modules with built-in barrier have Type “n”, and it can be placed in Zone 2. Modules with built-in barrier are listed below.

- ASI133 Analog Input Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- ASI533 Analog Output Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- AST143 TC/mV Input Module with Built-in Barrier (16-channel, Isolated)
- ASR133 RTD/POT Input Module with Built-in Barrier (8-channel, Isolated)
- ASD143 Digital Input Module with Built-in Barrier (16-channel, Isolated)
- ASD533 Digital Output Module with Built-in Barrier (8-channel, Isolated)

Explosion-proof Specifications and Complied Standard

[Explosion-proof specifications]

II (1) G D [EEx ia] II C

[Complied standard]

EN 50014: 1997 +A1 +A2

EN 50020: 1994

Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit. Wiring should be prepared in accordance with IEC 60079-14, or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

After setting, check the wiring according to the checklist described in IEC 60079-17.

See the Explosion Protection of FIO Products (IM 33K01J30-50E), for considerations for modules with built-in barrier.

Parameter of Intrinsic Safety

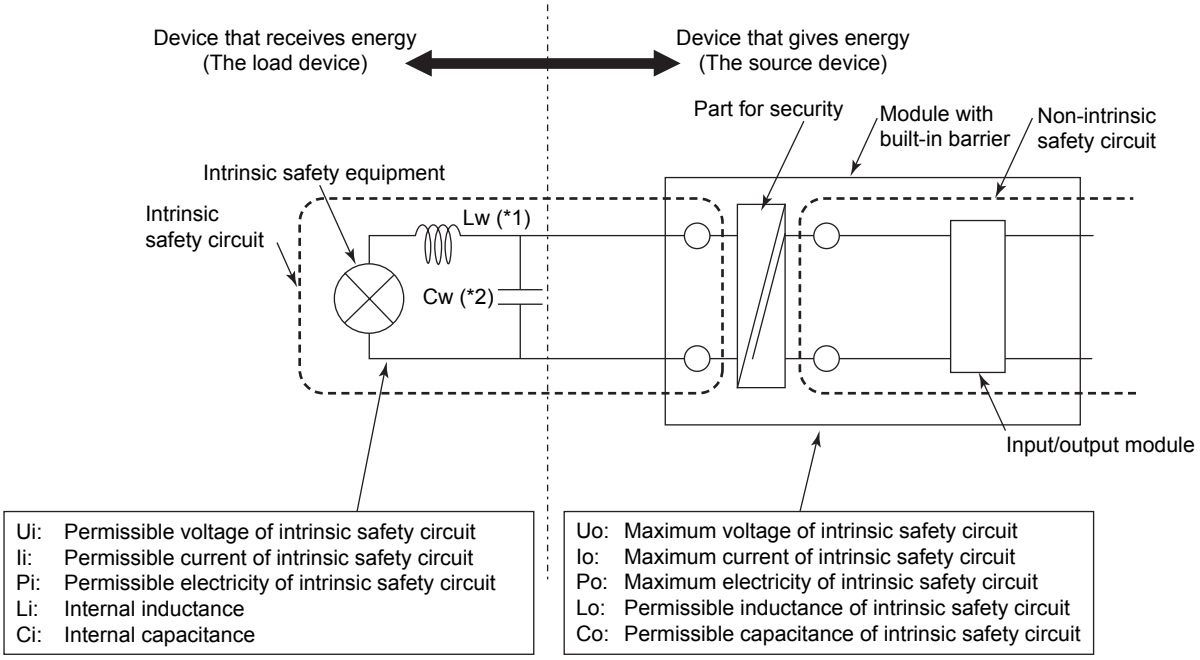
An intrinsic safety circuit of module with built-in barrier has the following ratings.

Maximum voltage of intrinsic safety circuit	Uo
Maximum current of intrinsic safety circuit	Io
Maximum electricity of intrinsic safety circuit	Po
Permissible inductance of intrinsic safety circuit	Lo
Permissible capacitance of intrinsic safety circuit	Co

As a combination of intrinsic safety circuits connected with module with built-in barrier and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

Uo	≤	Ui	
Io	≤	Ii	
Po	≤	Pi	
Lo	≥	Li+Lw	summation of Li in the device which receives energy + summation of inductance Lw in the external wiring
Co	≥	Ci+Cw	summation of Ci in the device which receives energy + summation of capacitance Cw in the external wiring

Intrinsic safety circuit should consist of circuitry to meet these condition of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.



*1: Lw: inductance of the external wiring
*2: Cw: capacitance of the external wiring

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Figure Composition Used for a Module with Built-in Barrier

Example of a Connection

Connect ESB Bus Node Unit to Equipment of Zone 0/1/2 Setting

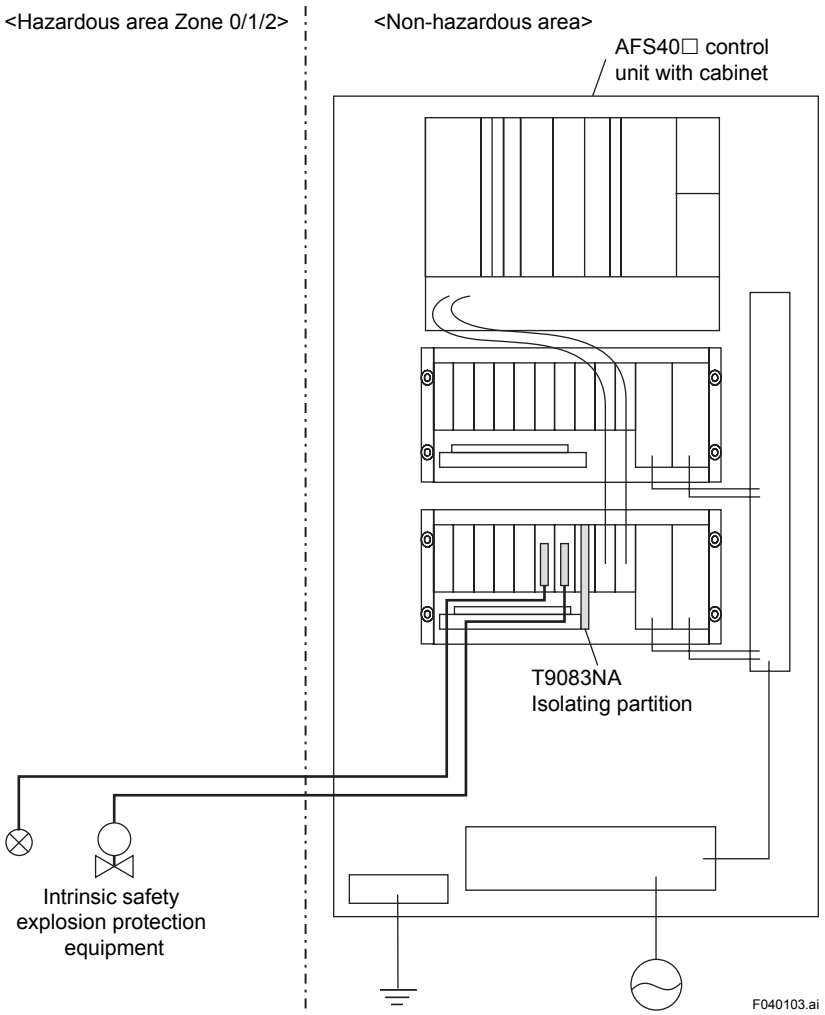


Figure Connect ESB Bus Node Unit to Equipment of Zone 0/1/2 Setting

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to IEC 60079-14 or the wiring for explosion protection which each country regulates.
- See Input & Output Modules (IM 33M50G10-40E, IM 33K50G10-50E), and Explosion Protection of FIO Products (IM 33K01J30-50E) for details on how to provide an isolating partition (Part No.: T9083NA).

Set ER Bus Node Unit and Module with Built-in Barrier in Zone 2

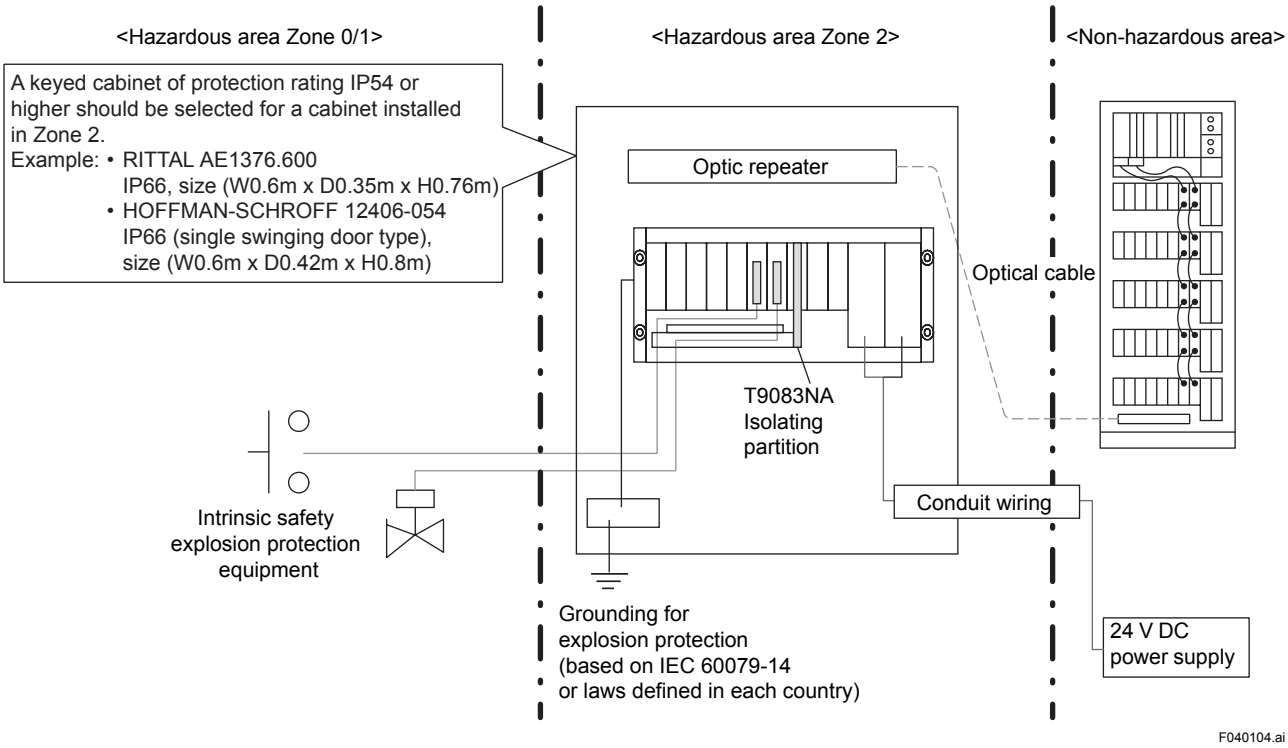


Figure Set ER Bus Node Unit and Module with Built-in Barrier in Zone 2

- To connect with a field device, electrical parameters of each device should be met.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to IEC 60079-14 or the wiring for explosion protection which each country regulates.
- The lead-in of the cabinet wiring installed in Zone 2 should be handled not to diminish a protection rating IP54 of the cabinet.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Zone 2.
- See Input & Output Modules (IM 33M50G10-40E, IM 33K50G10-50E), and Explosion Protection of FIO Products (IM 33K01J30-50E) for details on how to provide an isolating partition (Part No.: T9083NA).

4.1.2 Intrinsic Safety Explosion Protection of FM Standard

Modules with Built-in Barrier

The module with built-in barrier in CENTUM is equipment related with intrinsic safety, and a construction of explosion protection is implemented, by combination with intrinsic safety equipment placed in hazardous area. The module with built-in barrier eliminates the need for another barrier to connect with the equipment placed in Division 1 and Division 2. Modules with built-in barrier are listed below.

- ASI133 Analog Input Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- ASI533 Analog Output Module with Built-in Barrier

  (Supporting HART Communication, 4 to 20 mA, 8-channel, Isolated)
- AST143 TC/mV Input Module with Built-in Barrier (16-channel, Isolated)
- ASR133 RTD/POT Input Module with Built-in Barrier (8-channel, Isolated)
- ASD143 Digital Input Module with Built-in Barrier (16-channel, Isolated)
- ASD533 Digital Output Module with Built-in Barrier (8-channel, Isolated)

Explosion-proof Specifications and Complied Standard

[Explosion-proof specifications]

Associated intrinsically safe apparatus for connection to

Class I, II, and III, Division 1, Groups A, B, C, D, E, F and G, or

Class I, Zone 0, Group IIC

[Complied standard]

FM Class Number 3600: 2011

FM Class Number 3610: 2010

ANSI/ISA – 60079-0: 2009

ANSI/ISA – 60079-11: 2009

See also Appendix 4, Installation of I/O Modules with Built-in Barrier in accordance with FM Approval.

Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit. Wiring should be prepared in accordance with NEC (National Electric Code: ANSI/NFPA-70), or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

Parameter of Intrinsic Safety

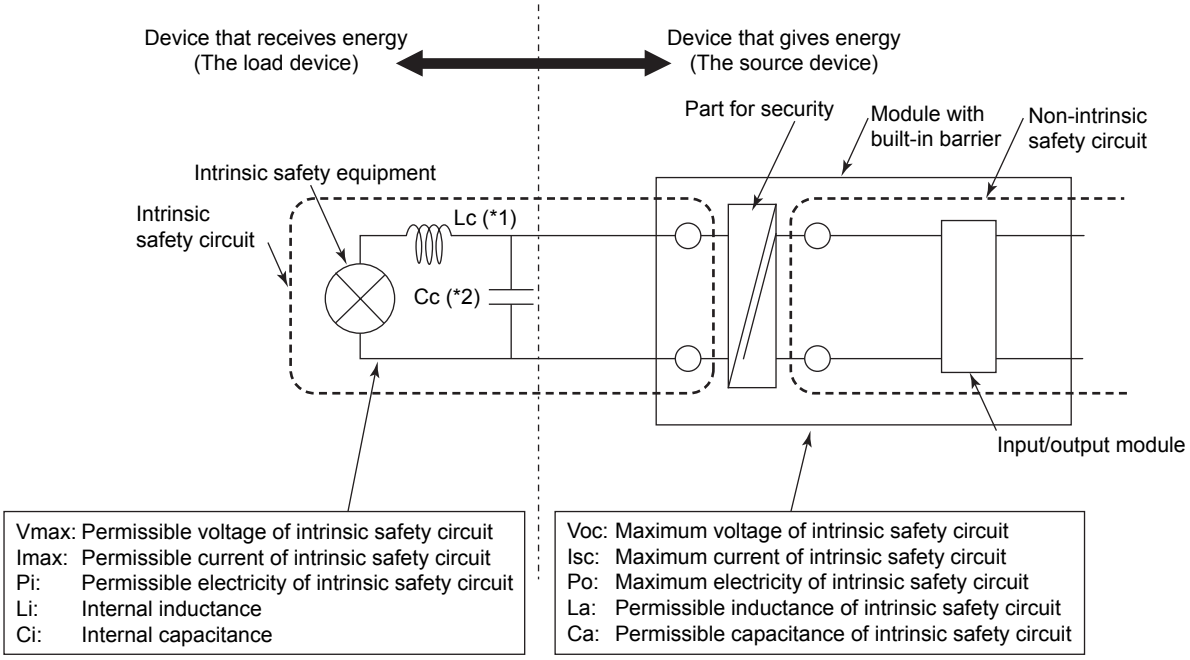
An intrinsic safety circuit of module with built-in barrier has the following ratings.

Maximum voltage of intrinsic safety circuit	Voc
Maximum current of intrinsic safety circuit	Isc
Maximum electricity of intrinsic safety circuit	Po
Permissible inductance of intrinsic safety circuit	La
Permissible capacitance of intrinsic safety circuit	Ca

As a combination of intrinsic safety circuits connected with module with built-in barrier and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

Voc	≤	Vmax	
Isc	≤	Imax	
Po	≤	Pi	
La	≥	Li+Lc	summation of Li in the device which receives energy + summation of inductance Lc in the external wiring
Ca	≥	Ci+Cc	summation of Ci in the device which receives energy + summation of capacitance Cc in the external wiring

Intrinsic safety circuit should consist of circuitry to meet these condition of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.



*1: Lc: inductance of the external wiring
*2: Cc: capacitance of the external wiring

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Figure Composition Used for a Module with Built-in Barrier

Example of a Connection

Connect ESB Bus Node Unit to Equipment of Division 1/2 Setting

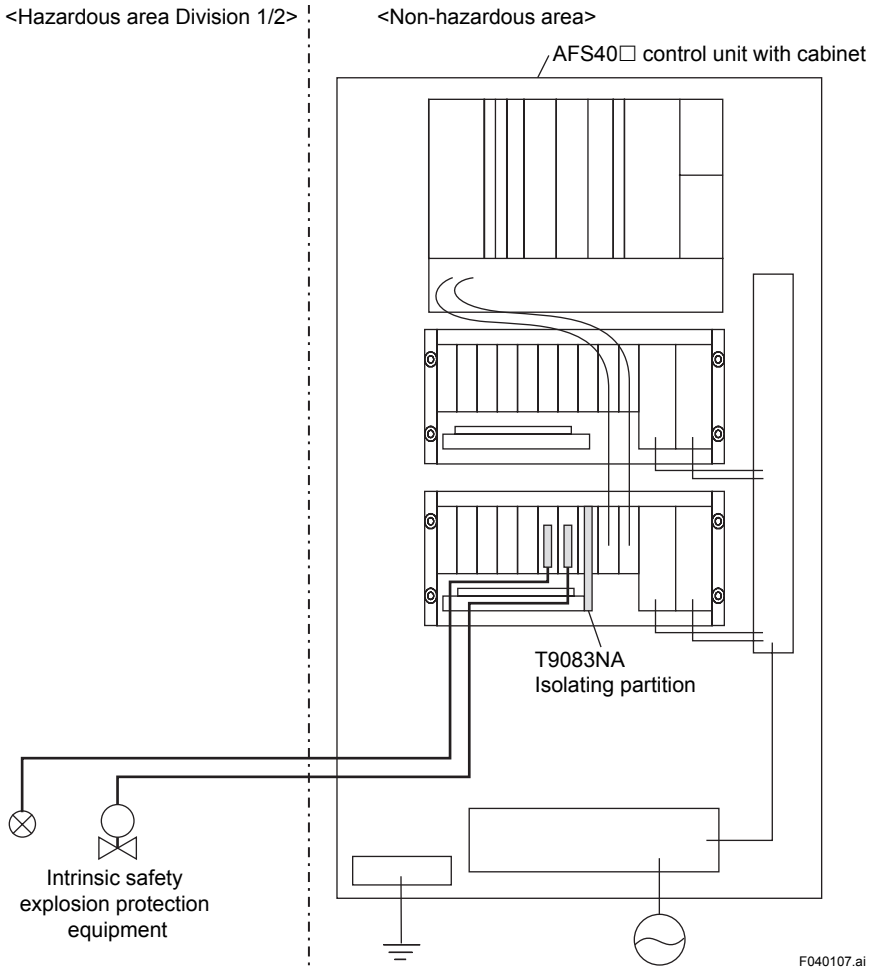


Figure Connect ESB Bus Node Unit to Equipment of Division 1/2 Setting

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to NEC (National Electric Code: ANSI/NFPA-70) or the wiring for explosion protection which each country regulates.
- When use for associated intrinsically apparatus complying FM approval (FM 3610), following Field Control Unit and Node unit using PW481-E1, PW482-E1, or PW484-E1 should be combinated.
  AFV10D-S41☐F1, AFV10S-S31☐F1, AFV10S-S41☐F1
  AFV30D-S41☐F1, AFV30S-S31☐F1, AFV30S-S41☐F1
  ANB10D-4☐F, ANB10S-3☐F, ANB10S-4☐F
  ANB10D-4☐G, ANB10S-3☐G, ANB10S-4☐G
  ANB11D-2☐F, ANB11D-4☐F, ANB11D-6☐F
  ANB11S-1☐F, ANB11S-2☐F, ANB11S-3☐F, ANB11S-4☐F
  ANB11S-5☐F, ANB11S-6☐F
  ANR10D-4☐F, ANR10S-3☐F, ANR10S-4☐F
- In the case of 200 V AC, make sure the N side is grounded.
- See Input & Output Modules (IM 33M50G10-40E, IM 33K50G10-50E), and Explosion Protection of FIO Products (IM 33K01J30-50E) for details on how to provide an isolating partition (Part No.: T9083NA).

Set ER Bus Node Unit and Module with Built-in Barrier in Division 2

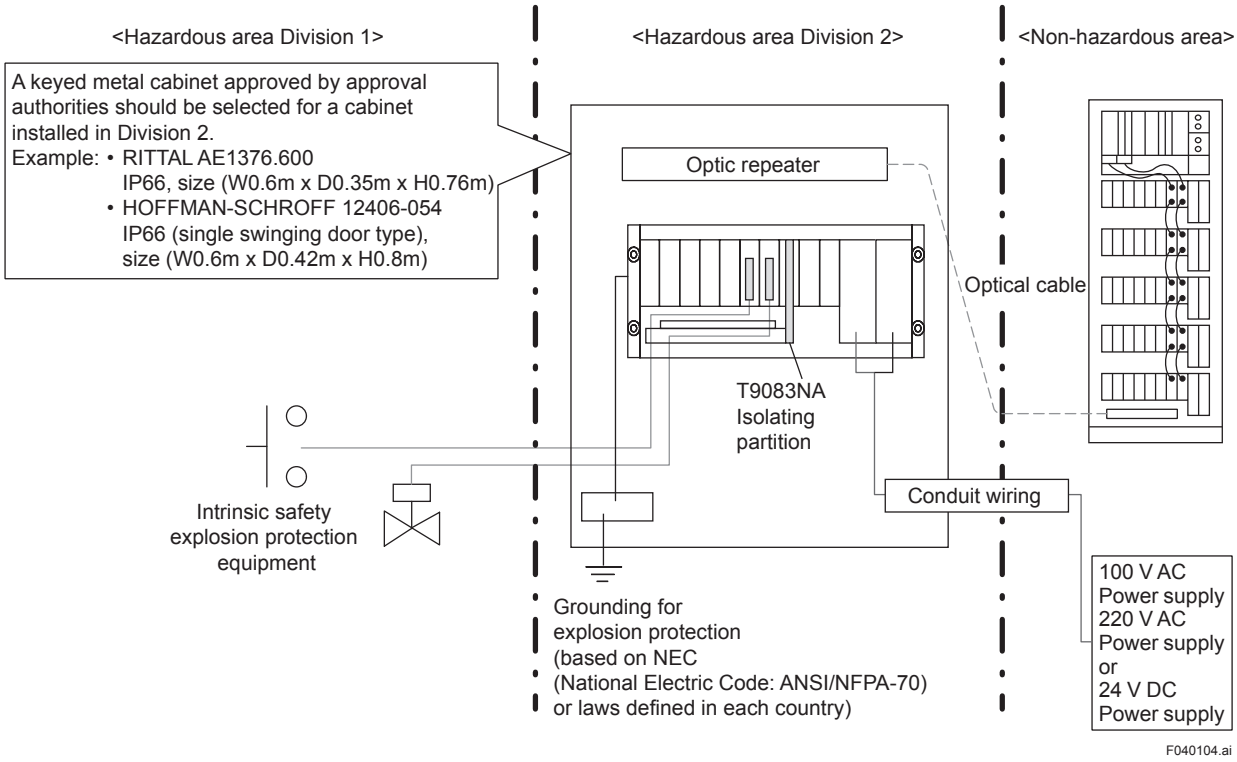


Figure Set ER Bus Node Unit and Module with Built-in Barrier in Division 2

- To connect with a field device, electrical parameters of each device should be met.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to NEC (National Electric Code: ANSI/NFPA-70) or the wiring for explosion protection which each country regulates.
- To wire the devices that do not indicate electrical parameters, apply an explosion-proof wiring (threaded conduit wiring) defined in NEC (National Electrical Code: ANSI/NFPA-70) or in each country.
- Use optical repeater (Network Devices) which can be installed in a hazardous area in Division 2.
- When use for associated intrinsically apparatus complying FM approval (FM 3610), following Field Control Unit and Node unit using PW481-E1, PW482-E1, or PW484-E1 should be combinated.

  AFV10D-S41□F1, AFV10S-S31□F1, AFV10S-S41□F1
  AFV30D-S41□F1, AFV30S-S31□F1, AFV30S-S41□F1
  ANB10D-4□F, ANB10S-3□F, ANB10S-4□F
  ANB10D-4□G, ANB10S-3□G, ANB10S-4□G
  ANB11D-2□F, ANB11D-4□F, ANB11D-6□F
  ANB11S-1□F, ANB11S-2□F, ANB11S-3□F, ANB11S-4□F
  ANB11S-5□F, ANB11S-6□F
  ANR10D-4□F, ANR10S-3□F, ANR10S-4□F
- In the case of 200 V AC, make sure the N side is grounded.
- See Input & Output Modules (IM 33M50G10-40E, IM 33K50G10-50E), and Explosion Protection of FIO Products (IM 33K01J30-50E) for details on how to provide an isolating partition (Part No.: T9083NA).

Set Optical ESB Bus Node Unit and Module with Built-in Barrier in Division 2

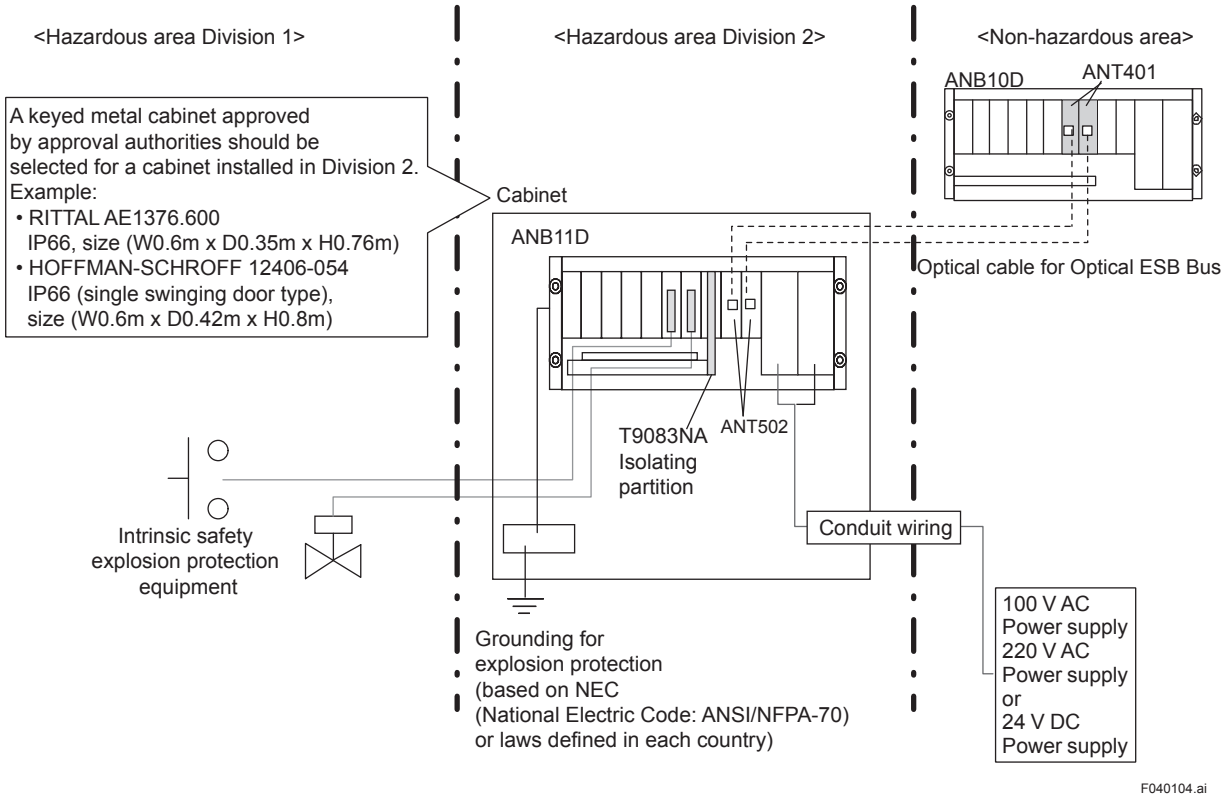


Figure Set Optical ESB Bus Node Unit and Module with Built-in Barrier in Division 2

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Including the wiring in cabinet, field wiring of intrinsic safety circuit and that of non-intrinsic safety circuit must be isolated each other. Wiring should be done, according to NEC (National Electric Code: ANSI/NFPA-70) or the wiring for explosion protection which each country regulates.
- When use for associated intrinsically apparatus complying FM approval (FM 3610), following Field Control Unit and Node unit using PW481-E1, PW482-E1, or PW484-E1 should be combinated.

  AFV10D-S41☐F1, AFV10S-S31☐F1, AFV10S-S41☐F1
  AFV30D-S41☐F1, AFV30S-S31☐F1, AFV30S-S41☐F1
  ANB10D-4☐F, ANB10S-3☐F, ANB10S-4☐F
  ANB10D-4☐G, ANB10S-3☐G, ANB10S-4☐G
  ANB11D-2☐F, ANB11D-4☐F, ANB11D-6☐F
  ANB11S-1☐F, ANB11S-2☐F, ANB11S-3☐F, ANB11S-4☐F
  ANB11S-5☐F, ANB11S-6☐F
  ANR10D-4☐F, ANR10S-3☐F, ANR10S-4☐F
- In the case of 200 V AC, make sure the N side is grounded.
- See Input & Output Modules (IM 33M50G10-40E, IM 33K50G10-50E), and Explosion Protection of FIO Products (IM 33K01J30-50E) for details on how to provide an isolating partition (Part No.: T9083NA).

4.2 Intrinsic Safety Explosion Protection Instrumentation Using Barriers

Category of Barriers

Classified roughly, barriers includes Zener barriers and insulating barriers (intrinsic safety barriers). Select the best one as your system, with the knowledge of their future.

(1) Feature of Zener barriers

Zener barrier has a simple construction which consists of just Zener Diode and resistance.

As the circuit of hazardous area and non-hazardous area are not insulated, they request the single point ground by the bus bar of Zener barriers, so as not to be created the functionally unfavorable ground loop by double point ground. Moreover, in most countries, it is impossible to ground circuits in hazardous area.

A power supply for barrier is not required, because Zener barriers carry out the function for security just with Zener Diode and resistance.

(2) Feature of insulating barriers

On the other hand, insulating barriers does not request intrinsic safety ground because the place between input and output of them is insulated. It is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.

Considerations for Selection of Barrier

Here is a general explanation about the selection of barrier. On the occasion of implementing intrinsic safety Explosion Protection instrumentation, select a barrier according to the manufacture's specifications and estimates with the equipment.

(1) Approved standard

Make sure the barrier has the approved standard which is required for the installation site.

(2) Cost

Compared Zener barriers to insulating barriers about the general cost of the main unit only per a channel, the approximate proportion are 1 to 2. Also, insulating barriers request a power supply.

(3) Volume (dimensions)

Dimensions may influence the number of cabinet in which the barrier is set. Compared Zener barriers to insulating barriers about the size per a general channel, the approximate proportion are 1 to 2.

(4) Difficulty of wiring, necessity of insulating hazardous area circuit

Zener barriers always need intrinsic safety ground, and most model of them have the construction grounded through the bus bar. All the circuit on the same bus bar in hazardous area and non-hazardous area are grounded to the same electric potential. Moreover, in most countries, circuits in hazardous area need withstand voltage of 500 Vrms. Therefore, it is impossible to ground circuits in hazardous area and use them. Insulating barriers impose no restrictions like this, so it is possible to ground circuits in hazardous area and use them (single point ground). However, a power supply for barrier is additionally required.

(5) Failure rate

The construction of Zener barriers is simple, because they carry out the function for security just with Zener Diode and resistance. On the other hand, insulating barriers consist of various parts, because they have the function of insulation and energy restriction. Therefore, the failure rate of insulating barriers is generally higher than that of Zener barriers. In Zener barriers, problems are usually solved by replacement and, in insulating barriers by modification.

(6) Accuracy, response

In general, Zener barriers have advantages about accuracy and response, because insulating barriers usually have more complex signal path than Zener barriers.

(7) Withstand voltage

Withstand voltage is a rating which only insulating barriers have. Most of the models have 250 V or more AC/DC, so there's almost no problem at the time of instrumentation.

(8) Security rating

Security rating indicates the scale of energy that can be occurred in hazardous area of barrier in the case of the accident. It is usually described by the signage, such as Uo=n V, Io=n mA, Po=n W, Co=n μF, Lo=n mH (Um=n Vrms or DC: only insulating barriers).

(In FM standard, it is called entity parameter, including the parameter of (10), and is described such as Voc=n V, Isc=n mA, Ca=n μF, La=n mH).

(9) Permissible cable parameter

Permissible cable parameter indicates the scale (capacity, inductance) of hazardous area circuit (including cables) which can be connected to barriers. It is regulated by a barrier and a kind of gases. It is usually described by group (ex. IIC etc.=a kind of gases), n μF (capacity), n mH or n μH/Ω (inductance or L/R ratio).

(10) Voltage in non-hazardous area

In regards to Zener barriers, Vwkg (maximum working voltage) and Vmax (maximum permissible voltage) are regulated. In regards to insulating barriers, regulation of voltage is for power supply rating only, but the use conditions of circuit in non-hazardous area are different by models.

(11) Influence by resistance value between input and output

This is a matter of only Zener barriers. As resistance and fuse exist between terminals of input and output in a barrier, in regards to an application that pass an electric current, it is necessary to take account of voltage drop inside the barrier. Moreover, in some application, it is necessary to take account of Diode current leakage (usually several μA).

Wiring of Intrinsic Safety Explosion Protection

An intrinsic safety circuit must be isolated from non-intrinsic safety circuit.

Wiring should be prepared in accordance with IEC 60079-14, NEC (National Electrical Code : NFPA-70), or the standard of the country and the area in which it is set. In regards to the further wiring than the module with built-in barrier, take notice that it should be an intrinsic safety circuit. The wiring in cabinet should keep the distance to non-intrinsic safety circuit.

After setting, check the wiring according to the checklist described in IEC 60079-17.

See the IM 33Y06K01-90E, for considerations for modules with built-in barrier.

An intrinsic safety circuit of barrier is indicated by the following ratings.

Maximum voltage of intrinsic safety circuit	Uo
Maximum current of intrinsic safety circuit	Io
Maximum electricity of intrinsic safety circuit	Po
Permissible inductance of intrinsic safety circuit	Lo
Permissible capacitance of intrinsic safety circuit	Co

As a combination of intrinsic safety circuits connected with barriers and wiring, it is necessary to meet the following conditions to keep the intrinsic safety performance.

Uo	≤	Ui
Io	≤	Ii
Po	≤	Pi
Lo	≥	Li+Lw
Co	≥	Ci+Cw

Intrinsic safety circuit should consist of barriers to meet these conditions of permissible voltage, current, and electricity, and should be wired so that inductance and capacitance of its wiring doesn't exceed its permissible value.

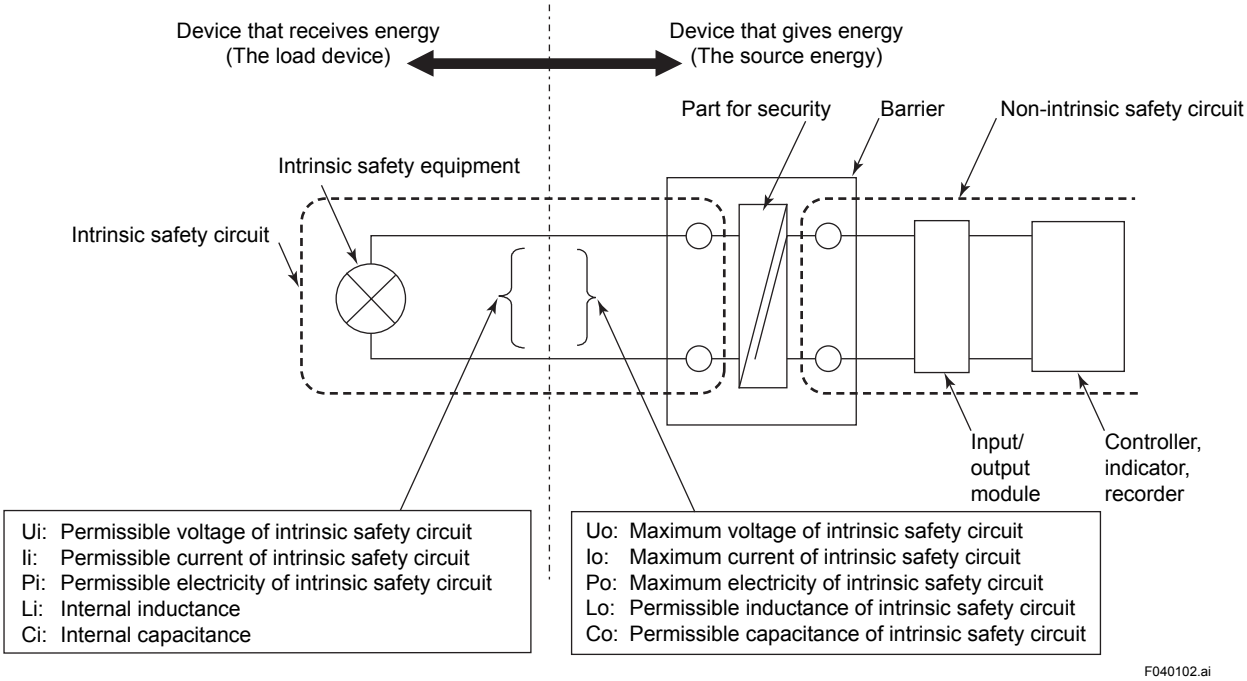


Figure Composition Used in a Barrier

Considerations for Zener Barriers in Use

Check the specifications of barrier, before you use it.

Considerations for Input Channel of Current

Note that the current value may have errors in a combination of FIO and Zener barrier.

In the system illustrated in the following figure, when the input module applies electric power to the transmitter, the input current value may have errors.

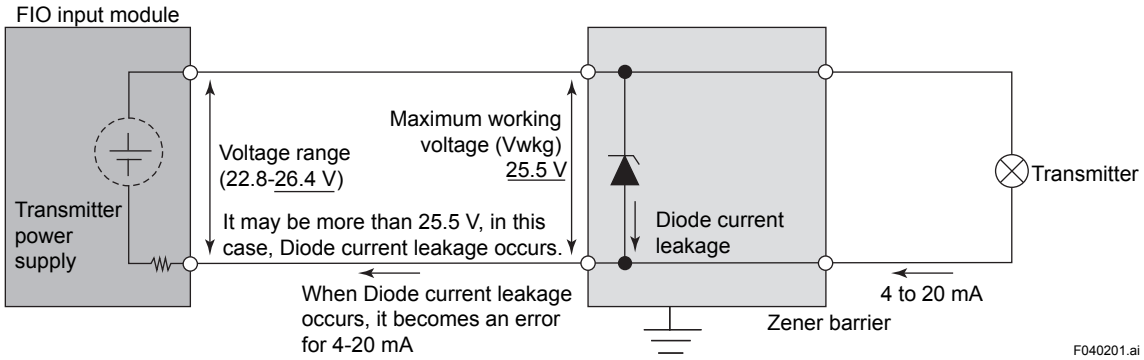

FIO input module
Transmitter power supply
Voltage range (22.8-26.4 V)
Maximum working voltage (Vwkg) 25.5 V
It may be more than 25.5 V, in this case, Diode current leakage occurs.
Diode current leakage
Transmitter
When Diode current leakage occurs, it becomes an error for 4-20 mA
4 to 20 mA
Zener barrier
F040201.ai

Figure Considerations for Current Input Channel

In FIO of CENTUM, when the input module applies electric power to the transmitter, applying voltage of 24 V may produce more than voltage of 25.5 V. In Zener barrier, if the voltage of more than 25.5 V is applied, the current runs on Diode, so that the excess of current doesn't apply. In this case, the quantity of current that passes on Diode for 4-20 mA signal from transmitter is added to the current applied to FIO input module, an error in a measurement are produced.

In RIO, as supply voltage does not exceed 25.5 V, no Diode current leakage generated and no error in a measurement are produced.

Note: In AAI143, although supply voltage is limited 25.5 V, Zener barrier cannot be connected because of the problem about wiring channel.

Considerations for Current Output Module

The current output module adjusts voltage so that it generates an appropriate value of current, and outputs it. The output module checks if the value of output current and that of actual current are the same. The current of 0 is considered as OOP. If the value of actual current is lower than that of output current, Readback error occurs, which is considered as a hardware mdule failure.

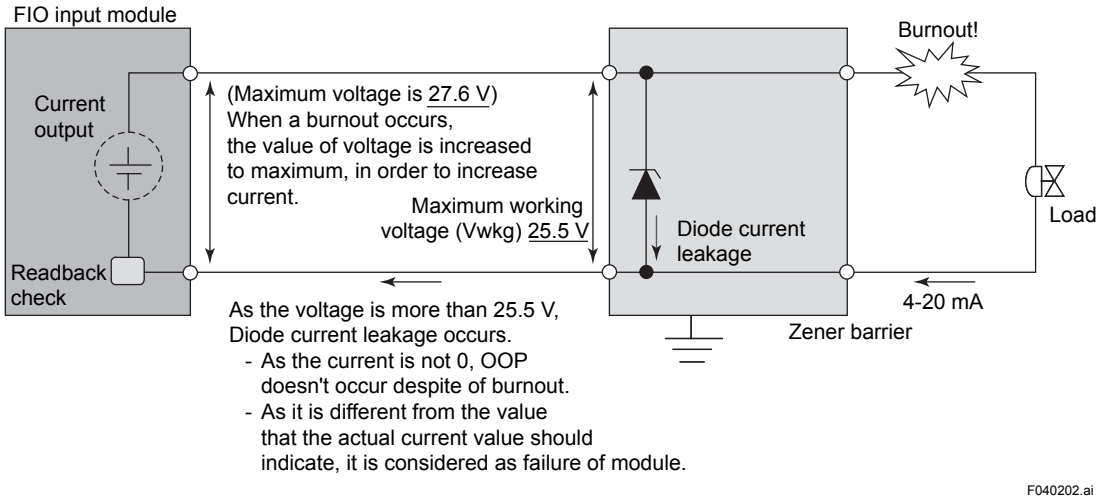

FIO input module
Current output
Readback check
(Maximum voltage is 27.6 V)
When a burnout occurs,
the value of voltage is increased
to maximum, in order to increase
current.
Maximum working voltage (Vwkg) 25.5 V
Diode current leakage
Burnout!
Load
4-20 mA
Zener barrier
As the voltage is more than 25.5 V,
Diode current leakage occurs.
- As the current is not 0, OOP doesn't occur despite of burnout.
- As it is different from the value that the actual current value should indicate, it is considered as failure of module.
F040202.ai

Figure Considerations for Output Module of Current

The voltage of more than 25.5 V produces Diode current leakage, so that the value of current never becomes 0 in Readback check, despite of burnout. Therefore, the check of OOP is not available. The value of current is considered as failure of module, because it is different from the value of output current. In RIO module, as the voltage is constant and 25.5 V or less, there is no disadvantage like this.

Example of Connection at the Barrier in Use (Connection Using Marshalling Panel)

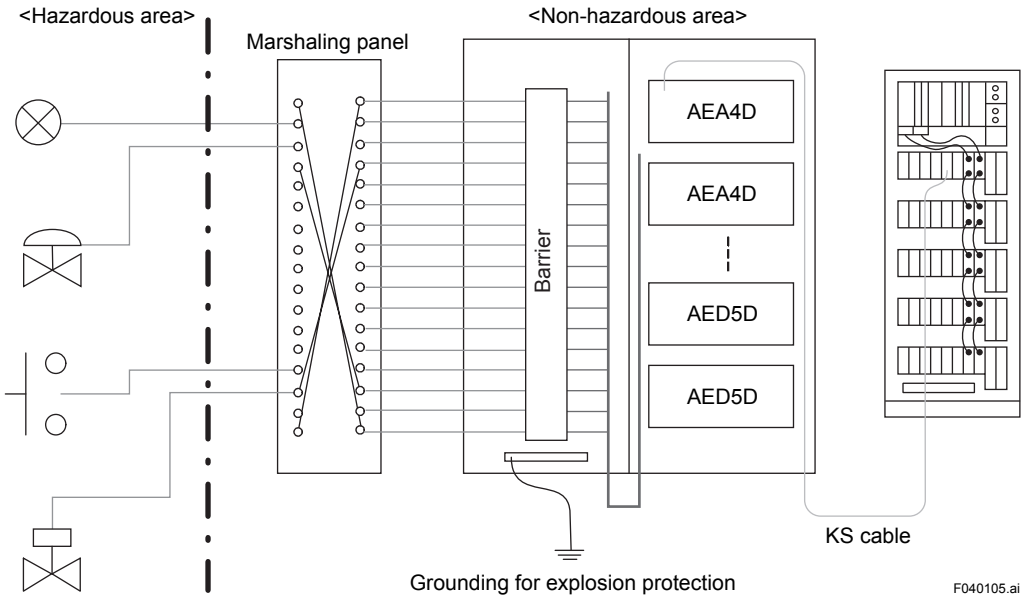


Figure Example of Connection at the Barrier in Use (Connection Using Marshaling Panel)

- The barrier should be connected with field equipment in accordance with the electric parameter of each equipment.
- Creepage distance between intrinsic safety circuit and non-intrinsic safety circuit should be kept 50 mm or more.
- Wiring should be prepared in accordance with IEC 60079-14, NEC (National Electrical Code : ANSI/NFPA-70), CEC (Canadian Electrical Code), or the wiring for explosion protection that each country regulates.

Appendix 1. Lists of NI Compliant Products and NI Parameters

Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters

The List of CSA NI Compliant Products

Table The List of CSA NI Compliant Products <for FIO> (1/4)

Classifications	Type names	Products
Node unit	ANB10S-□1E ANB10S-□1F ANB10S-□1G	Node Unit for Single ESB Bus (100 V AC power supply)
	ANB10S-□4E ANB10S-□4F ANB10S-□4G	Node Unit for Single ESB Bus (24 V DC power supply)
	ANB10D-41E ANB10D-41F ANB10D-41G	Node Unit for Dual-Redundant ESB Bus (100 V AC power supply duplication)
	ANB10D-44E ANB10D-44F ANB10D-44G	Node Unit for Dual-Redundant ESB Bus (24 V DC power supply duplication)
	ANB11S-□1E ANB11S-□1F	Node Unit for Single ESB Bus with Optical Repeater (100 V AC power supply)
	ANB11S-□4E ANB11S-□4F	Node Unit for Single ESB Bus with Optical Repeater (24 V DC power supply)
	ANB11D-□1E ANB11D-□1F	Node Unit for Dual-Redundant ESB Bus with Optical Repeater (100 V AC power supply duplication)
	ANB11D-□4E ANB11D-□4F	Node Unit for Dual-Redundant ESB Bus with Optical Repeater (24 V DC power supply duplication)
	ANR10S-□1E ANR10S-□1F	Node unit for ER bus single (100 V AC power supply)
	ANR10S-□4E ANR10S-□4F	Node unit for ER bus single (24 V DC power supply)
	ANR10D-41E ANR10D-41F	Node unit for ER bus duplication (100 V AC power supply duplication)
	ANR10D-44E ANR10D-44F	Node unit for ER bus duplication (24 V DC power supply duplication)
	ANR11S-□1E ANR11S-□1F	Node Unit for Single ER Bus (100 V AC power supply)
	ANR11S-□4E ANR11S-□4F	Node Unit for Single ER Bus (24 V AC power supply)
	ANR11D-41E ANR11D-41F	Node Unit for Dual-Redundant ER Bus (100 V AC power supply duplication)
	ANR11D-44E ANR11D-44F	Node Unit for Dual-Redundant ER Bus (24 V AC power supply duplication)
Unit	ANT10U-□1E ANT10U-□1F	Unit for Optical ESB Bus Repeater Module (100 V AC power supply)
	ANT10U-□4E ANT10U-□4F	Unit for Optical ESB Bus Repeater Module (24 V DC power supply)
Power supply module	PW481-E□	100 V AC power supply module
	PW484-E□	24 V DC power supply module

Note: Any accessories for maintenance are CSA NI approved products.

Table The List of CSA NI Compliant Products <for FIO> (2/4)

Classifications	Type names	Products
Bus interface module	SB401-E□	ESB Bus Interface Slave Module
	EB501-E□	ER bus interface slave module
	EB511-E□	ER bus interface slave module
	ANT502-E□	Optical ESB Bus Repeater Slave Module
	ANT512-E□	Optical ESB Bus Repeater Slave Module
	ANT522-E□	Optical ESB Bus Repeater Slave Module (for Multimode Fiber)
I/O module	AAI141-□E□	Analog input module (4 to 20 mA, 16 points, non-insulation)
	AAV141-SE□	Analog input module (1 to 5 V, 16 points, non-insulation)
	AAV142-SE□	Analog input module (-10 to +10 V, 16 points, non-insulation)
	AAB141-HE□	Analog input module (1 to 5 V/4 to 20 mA, 16-channel, non-isolated)
	AAI841-□E□	Analog I/O module (4 to 20 mA, 8 input points/8 output points, non-insulation)
	AAB841-SE□	Analog I/O module (1 to 5 V output 4 to 20 mA, 8 input points/8 output points, non-insulation)
	AAB842-HE□	Analog I/O module (1 to 5 V / 4 to 20 mA input, 4 to 20 mA output, 8-channel input/ 8-channel output, non-isolated)
	AAV542-SE□	Analog output module (-10 to +10 V, 16 points, non-insulation)
	AAI143-□E□	Analog input module (4 to 20 mA, 16 points, whole insulation)
	AAI543-□E□ AAI543-□F□	Analog output module (4 to 20 mA, 16 points, whole insulation)
	AAV144-SE□	Analog input module (-10 to +10 V, 16 points, whole insulation)
	AAV544-SE□	Analog output module (-10 to +10 V, 16 points, whole insulation)
	AAT141-SE□	Thermocouple/mV input module (16 points, whole insulation)
	AAR181-SE□	RTD input module (12 points, whole insulation)
	AAI135-□E□	Analog input module (4 to 20 mA, 8 points, individual insulation)
	AAI835-□E□	Analog I/O module (4 to 20 mA, 4 points input /4 points output, individual insulation)
	AAP135-SE□	Pulse input module (0 to 10 kHz, 8 points, individual insulation)
	AAT145-SE□	Thermocouple/mV input module (16 points, individual insulation)
	AAR145-SE□	RTD/slide rheostat input module (16 points, individual insulation)
	ADV151-PE□ ADV151-PF□	Digital input module (32 points, pulse-count function)
	ADV551-PE□ ADV551-PF□ (*1)	Digital output module (32 points, pulse with output function)
	ADV141-PE□	Digital input module (16 points, 100 V AC, pulse-count function)
	ADV157-SE□	Digital input module (32 points, for press-tightening terminal only)
	ADV557-SE□	Digital output module (32 points, for press-tightening terminal only)
	ADV161-PE□	Digital input module (64 points, pulse-count function)
	ADV561-PE□ (*1)	Digital output module (64 points, pulse-count function)
	ADR541-PE□	Relay output module (16 points, pulse with output function)
	ALF111-SE□	Fieldbus (FF-H1) communication module
Terminal block	ATA4D	Duplicated press-tightening terminal block for analog
	ATT4D	Duplicated press-tightening terminal block for thermocouple/mV
	ATR8D	Duplicated press-tightening terminal block for RTD
	ATB5D	Duplicated press-tightening terminal block for digital input
	ATD5D	Duplicated press-tightening terminal block for digital output
	ATI3D	Duplicated press-tightening terminal block for analog individual insulation
	ATA4S	Single press-tightening terminal block for analog
	ATT4S	Single press-tightening terminal block for thermocouple/mV
	ATR8S	Single press-tightening terminal block for digital RTD
	ATB5S	Single press-tightening terminal block for digital input
	ATD5S	Single press-tightening terminal block for digital output

Note: Any accessories for maintenance are CSA NI approved products.
*1: For the combination of ADV551 and AED5D or A1BD5D, or ADV561 and AED5D or A1BD5D in voltage output mode (means powering a external load from AED5D or A1BD5D), the CSA NI field wiring cannot be made.

Table The List of CSA NI Compliant Products <for FIO> (3/4)

Classifications	Type names	Products
Terminal block	ATI3S	Single press-tightening terminal block for analog individual insulation
	ATC4S-5□	Press-tightening terminal block for digital (for 100 V AC input)
	ATC4S-7□	Press-tightening terminal block for digital (for relay output)
	ATC5S	Press-tightening terminal block for digital (for ADV157, ADV557)
	ATF9S	Press-tightening terminal block for fieldbus
	ATK4A	KS cable interface adapter (for analog)
	ATM4A	KS cable interface adapter (for MAC2 compatible)
	ATV4A	KS cable interface adapter (for VM2 compatible)
	ATI3A	KS cable interface adapter (for AAI135, AAP135)
	ATB3A	KS cable interface adapter (for AAI835)
	ATD5A	KS cable interface adapter (for digital)
Terminal board	AEA3D-0E AEA3D-0F	Analog/single, Duplicated terminal board (8 points x 4)
	AEA4D-0E AEA4D-0F	Analog/single, Duplicated terminal board (16 points x 2 or 8 points x 2)
	A1BA4D-0E A1BA4D-0F	Terminal Board for Analog (16 points x 1 or 8 points x 1)
	AET4D-0E AET4D-0F	Thermocouple/single, Duplicated terminal board (16 points x 2)
	A1BT4D-0E A1BT4D-0F	Terminal Board for Thermocouple (16 points x 1)
	AER4D-0E AER4D-0F	RTD/ slide rheostat single, duplicated terminal board (16 points)
	A1BR4D-0E A1BR4D-0F	Terminal Board for RTD input (16 points x 1)
	AED5D-0E AED5D-0F (*1)	Digital/single, duplicated terminal board (32 points x 2)
	A1BD5D-0E A1BD5D-0F (*1)	Terminal Board for Digital (32 points x 1)
	AEC4D-5E AEC4D-5F	Digital/single, duplicated terminal board (for 100 V AC input)
	AEC4D-7E AEC4D-7F	Digital/single, duplicated terminal board (for relay output)
	AEF9D-0E AEF9D-0F	Fieldbus/single, duplicated terminal board
	MRT	Terminal board for RTD
	TERT	Terminal block for RTD (16 points)
Bus cable	YCB301	ESB Bus Cable
	YCB141	ER bus cable
	YCB311	ER bus extension cable
	YCB147-E YCB147-F	ER bus cable conversion adapter
Signal cable (*2)	AKB331	Signal cable (ADV151, between ADV551 and terminal board)
	AKB332	Signal cable (between ADV141 and terminal board)
	AKB334	Signal cable (between ADR541 and terminal board)
	AKB335	Signal cable (between AAR145 and AER4D)
	AKB336	Signal cable (between ALF111 and terminal board)
	AKB337	Signal cable (ADV161, between ADV561 and terminal board)
	KS1	Signal cable (40 - 40 pin)
	KS8	Signal cable (50 - 50 pin)

Note: Any accessories for maintenance are CSA NI approved products.
*1: For the combination of ADV551 and AED5D or A1BD5D, or ADV561 and AED5D or A1BD5D in voltage output mode (means powering a external load from AED5D or A1BD5D), the CSA NI field wiring cannot be made..
*2 For CSA Non-Incendive instrumentation, specify the option code "/NL".

Table The List of CSA NI Compliant Products <for FIO> (4/4)

Classifications	Type names	Products
I/O module	EB401-E□	ER bus interface master module
	ANT401-E□	Optical ESB Bus Repeater Master Module
	ANT411-E□	Optical ESB Bus Repeater Master Module
	ANT421-E□	Optical ESB Bus Repeater Master Module (for Multimode Fiber)
Distribution unit	AEP7D-1E AEP7D-1F	Primary distribution unit (for 100 V AC input)
	AEP7D-4E AEP7D-4F	Primary distribution unit (for 24 V DC input)
	AEPV7D-1□E AEPV7D-1□F	Power Supply Bus Unit, Vertical Type
Distribution unit	AEPV7D-4□E AEPV7D-4□F	Power Supply Bus Unit, Vertical Type
	AEP9D-4E AEP9D-4F	Secondary distribution unit

Note: Any accessories for maintenance are CSA NI approved products.

Table The List of CSA NI Compliant Products <for RIO> (1/2)

Classifications	Type names	Products
Node interface unit	ANS50-5□1	Node interface unit for RIO bus single (100 V AC power supply)
	ANS50-5□4	Node interface unit for RIO bus single (24 V DC power supply)
	AND50-5□1	Node interface unit for RIO bus duplication (100 V AC power supply)
	AND50-5□4	Node interface unit for RIO bus duplication (24 V DC power supply)
Optical bus repeater	YNT511□-R41	Optical bus repeater (for RIO bus, 100 V AC power supply, for 4 km or less)
	YNT511□-R44	Optical bus repeater (for RIO bus, 24 V DC power supply, for 4 km or less)
	YNT521□-R11	Optical bus repeater (for RIO bus, 100 V AC power supply, for 15 km or less)
	YNT521□-R14	Optical bus repeater (for RIO bus, 24 V DC power supply, for 15 km or less)
I/O module nest	AMN11	Nest for analog I/O module
	AMN12	High speed type nest for analog I/O module
	AMN21	Nest for relay I/O module
	AMN31	Terminal type I/O module nest
	AMN32	Connector type I/O module nest
	AMN33	Nest for communication module
	AMN34	Multiple control analog I/O module nest
I/O module	AAM10	Current/Voltage input module
	AAM11	Current/Voltage input module
	AAM11B	Current/Voltage input module
	AAM21	mV, thermocouple, RTD input module
	AAM21J	mV, thermocouple, RTD input module (JIS C1602-1995, C1604-1997 compliant)
	APM11	Pulse input module
	AAM50	Current output module
	AAM51	Current/Voltage output module
	AMM12T	Voltage input multiplexer module (terminal type)
	AMM12C	Voltage input multiplexer module (connector type)
	AMM22M	mV input multiplexer module
	AMM22T	Thermocouple input multiplexer module
	AMM22TJ	Thermocouple input multiplexer module (16 points terminal type, JIS C1602-1995 compliant)
	AMM22C	mV input multiplexer module (16 points connector type)
	AMM32T	RTD input multiplexer module (16 points terminal type)
	AMM32TJ	RTD input multiplexer module (16 points terminal type, JIS C1604-1997 compliant)
	AMM32C	RTD input multiplexer module (16 points connector type)
	AMM32CJ	RTD input multiplexer module (16 points connector type, JIS C1604-1997 compliant)
	AMM42T	Two wired transmitter input multiplexer module
	AMM52T	Current output multiplexer module

Note: Accessories for maintenance are CSA NI approved products.

Table The List of CSA NI Compliant Products <for RIO> (2/2)

Classifications	Type names	Products
I/O module	ADM11T	Contact input module (16 points, terminal type)
	ADM11C	Contact input module (16 points, connector type)
	ADM12T	Contact input module (32 points, terminal type)
	ADM12C	Contact input module (32 points, connector type)
	ADM51T-1, ADM51T-2	Contact output module (16 points, terminal type)
	ADM51C-1, ADM51C-2	Contact output module (16 points, connector type)
	ADM52T-1, ADM52T-2	Contact output module (32 points, terminal type)
	ADM52C-1, ADM52C-2	Contact output module (32 points, connector type)
	ADM15R	Relay input module
	ADM55R-1, ADM55R-2	Relay output module
	ACM11	RS-232C communication module
	ACM12	RS-422/RS-485 communication module
	ACF11	Fieldbus communication module
	AMC80	Analog I/O module for multiple control
Terminal block	TE16	Terminal block for 16 points
	TE32	Terminal block for 32 points
Terminal board	MCM	Terminal board
	MUB	General-purpose terminal board (16 points board)
	MUD	General-purpose terminal board (32 points board)
	MRT	Terminal board for RTD
Bus cable	YCB121	RIO bus cable
Signal cable (*1)	KS1	Signal cable (40-40 pins)
	KS2	Signal cable (40-40 pins)
	KS8	Signal cable (50-50 pins)
	KS9	Signal cable (50-50 pins)

Note: Accessories for maintenance are CSA NI approved products.
*1: For CSA Non-Incendive instrumentation, specify the option code “/NL”.

Parameters of CSA NI Compliant Equipments

FIO

The appropriate I/O modules and parameters are as follows.
The appropriate equipments are source devices.

Table FIO Parameters (The Source Devices) (1/2)

Module name		Voc (V)	Isc (mA)	Ca (μF)	La (mH)	Vn (V)	In (mA)	Cn (μF)	Ln (mH)	Remarks (*1)
SB401-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
EB501-E□		9.4	45.0	0.39	0.46	1.2	45.0	0.39	10.0	With terminating resistance 50 Ω (*2)
EB511-E□		4.0	50.0	0.019	0.27	2.1	42.0	0.019	10.0	
ANT502-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
ANT512-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
ANT522-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
AAI141-□E□	Dual	27.6	54.0	0.12	2.7	27.6	24.0	0.12	100.0	If two-wired type is set
	Single	27.6	27.0	0.19	2.7	27.6	24.0	0.19	100.0	If two-wired type is set
AAI143-□E□	Dual	25.5	26.3	0.22	21.9	25.5	23.0	0.22	100.0	If two-wired type is set
	Single	25.5	26.3	0.22	21.9	25.5	23.0	0.22	100.0	If two-wired type is set
AAI841-□E□ Input	Dual	27.6	54.0	0.12	2.7	27.6	24.0	0.12	100.0	If two-wired type is set
	Single	27.6	27.0	0.19	2.7	27.6	24.0	0.19	100.0	If two-wired type is set
AAI841-□E□ Output	Dual	27.6	23.0	0.12	19.0	27.6	23.0	0.12	100.0	
	Single	27.6	23.0	0.19	19.0	27.6	23.0	0.19	100.0	
AAB841-SE□ Output	Dual	27.6	23.0	0.12	19.0	27.6	23.0	0.12	100.0	
	Single	27.6	23.0	0.19	19.0	27.6	23.0	0.19	100.0	
AAI543-□E□ AAI543-□F□	Dual	24.3	23.0	0.33	21.9	24.3	23.0	0.33	100.0	
	Single	24.3	23.0	0.33	21.9	24.3	23.0	0.33	100.0	
AAI835-□E□ **[Style S1, S2]** Input	Dual	31.0	31.0	0.25	15.4	31.0	24.0	0.25	100.0	If two-wired transmitter is set
	Single	31.0	31.0	0.12	15.4	31.0	24.0	0.12	100.0	If two-wired transmitter is set
AAI835-□E□ **[Style S1, S2]** Output	Dual	31.0	23.0	0.15	40.0	31.0	23.0	0.15	100.0	
	Single	31.0	23.0	0.12	40.0	31.0	23.0	0.12	100.0	
AAI835-□E□ **[Style S3]** Input	Dual	26.0	31.0	0.25	15.4	26.0	24.0	0.25	100.0	If two-wired transmitter is set
	Single	26.0	31.0	0.12	15.4	26.0	24.0	0.12	100.0	If two-wired transmitter is set
AAI835-□E□ **[Style S3]** Output	Dual	29.3	23.0	0.15	40.0	29.3	23.0	0.15	100.0	
	Single	29.3	23.0	0.12	40.0	29.3	23.0	0.12	100.0	
AAI135-□E□ **[Style S1, S2]**	Dual	31.0	31.0	0.25	15.4	31.0	24.0	0.25	100.0	If two-wired transmitter is set
	Single	31.0	31.0	0.12	15.4	31.0	24.0	0.12	100.0	If two-wired transmitter is set
AAI135-□E□ **[Style S3]**	Dual	26.0	31.0	0.25	15.4	26.0	24.0	0.25	100.0	If two-wired transmitter is set
	Single	26.0	31.0	0.12	15.4	26.0	24.0	0.12	100.0	If two-wired transmitter is set
AAP135-SE□		—	—	—	—	—	—	—	—	Non-compliant (*3)
AAV542-SE□	Dual	11.0	11.7	0.27	20.0	11.0	11.7	0.27	100.0	
	Single	11.0	11.7	0.4	20.0	11.0	11.7	0.4	100.0	

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: EB401 and EB501 can be connected in parallel each other without any regard for the order.
*3: All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

Table FIO Parameters (The Source Devices) (2/2)

Module name		Voc (V)	Isc (mA)	Ca (μF)	La (mH)	Vn (V)	In (mA)	Cn (μF)	Ln (mH)	Remarks (*1)
AAV544-SE□	Dual	11.8	12.5	0.27	20.0	11.8	12.5	0.27	100.0	
	Single	11.8	12.5	0.4	20.0	11.8	12.5	0.4	100.0	
AAR181-SE□	Dual	5.25	1.0	1.0	20.0	5.25	1.0	5.0	100.0	
	Single	5.25	1.0	1.0	20.0	5.25	1.0	5.0	100.0	
AAT145-SE□	Dual	5.0	0.5	1.0	20.0	1.25	0.125	1.0	100.0	RJC input
	Single	5.0	0.5	1.0	20.0	1.25	0.125	1.0	100.0	RJC input
AAT145-SE□	Dual	16.5	33.4	0.3	0.8	16.5	5.0	0.3	0.8	Power supply for RJC
	Single	16.5	16.7	0.3	0.8	16.5	5.0	0.3	0.8	Power supply for RJC
AAT145-SE□	Dual	16.5	33.0	0.3	0.8	16.5	4.4	0.3	0.8	Detection of unplugged cable
	Single	16.5	16.5	0.3	0.8	16.5	2.2	0.3	0.8	Detection of unplugged cable
AAR145-SE□	Dual	5.0	1.1	1.0	20.0	5.0	1.1	1.0	100.0	RTD/POT input
	Single	5.0	1.1	1.0	20.0	5.0	1.1	1.0	100.0	RTD/POT input
AAR145-SE□	Dual	26.4	52.8	0.3	0.8	26.4	4.0	0.3	0.8	Detection of unplugged cable
	Single	26.4	26.4	0.3	0.8	26.4	2.0	0.3	0.8	Detection of unplugged cable
AAB842-HE□ Output	Dual	27.6	23.0	0.12	19.0	27.6	23.0	0.12	100.0	
	Single	27.6	23.0	0.19	19.0	27.6	23.0	0.19	100.0	
ADV151-PE□ ADV151-PF□	Dual	—	—	—	—	—	—	—	—	Contact input mode (*3)
	Single	—	—	—	—	—	—	—	—	
ADV161-PE□	Dual	—	—	—	—	—	—	—	—	Contact input mode (*3)
	Single	—	—	—	—	—	—	—	—	
ADV551-PE□ ADV551-PF□	Dual	NI field wiring cannot be made (because the combination of this module and terminal boards cannot create current limit during supplying energy for NI equipment external wiring).								Voltage output mode (*3)
	Single									
ADV561-PE□	Dual	NI field wiring cannot be made (because the combination of this module and terminal boards cannot create current limit during supplying energy for NI equipment external wiring).								Voltage output mode (*3)
	Single									
EB401-E□		9.4	45.0	0.39	0.46	1.2	45.0	0.39	10.0	With terminating resistance 50 Ω (*2)
ANT401-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
ANT411-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
ANT421-E□	Dual	—	—	—	—	—	—	—	—	(*3)
	Single	—	—	—	—	—	—	—	—	(*3)
AEPV7D-1□E AEPV7D-1□F	CN1 to CN7	—	—	—	—	—	—	—	—	
AEPV7D-4□E AEPV7D-4□F	CN1 to CN7	—	—	—	—	—	—	—	—	

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: EB401 and EB501 can be connected in parallel each other without any regard for the order.
*3: All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

The appropriate products are load devices which received energy from CSA NI equipments.

Table FIO Parameters (The Load Devices) (1/2)

Module name		Vmax (V)	Imax (mA)	Ci (µF)	Li (µH)	Remarks (*1) (mode, terminals)
SB401-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
EB501-E□		10.0	0.9 µA	8.0 pF	0.1	With terminating resistance 50 Ω
EB511-E□		4.0	50.0	40.0 pF	0.3	
ANT502-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
ANT512-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
ANT522-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
AAI141-□E□	Dual	20.0	60.0	4200 pF	3.6	If four-wired type is set
	Single	12.0	30.0	3100 pF	4.8	If four-wired type is set
AAI143-□E□	Dual	25.5	26.3	7000 pF	10.0	If four-wired type is set
	Single	25.5	26.3	3500 pF	10.0	If four-wired type is set
AAI841-□E□ Input	Dual	20.0	60.0	4200 pF	3.6	If four-wired type is set
	Single	12.0	30.0	3100 pF	4.8	If four-wired type is set
AAI835-□E□ Input	Dual	8.2	31.0	8600 pF	2.0	If four-wired transmitter is connected
	Single	8.2	31.0	5300 pF	4.0	If four-wired transmitter is connected
AAI135-□E□	Dual	8.2	31.0	8600 pF	2.0	If four-wired transmitter is connected
	Single	8.2	31.0	5300 pF	4.0	If four-wired transmitter is connected
AAP135-SE□	Dual	25.0	72.0	2.21	0	If power 24 V DC is supplied
	Single	25.0	36.0	1.11	0	If power 24 V DC is supplied
AAP135-SE□	Dual	25.0	96.0	2.21	0	If power 12 V DC is supplied
	Single	25.0	48.0	1.11	0	If power 12 V DC is supplied
AAV142-SE□	Dual	13.0	26.0 µA	0.057	0.438	
	Single	13.0	13.0 µA	0.03	0.880	
AAV141-SE□	Dual	7.5	15.0 µA	0.146	2.4	
	Single	7.5	7.5 µA	0.074	4.8	
AAV144-SE□	Dual	30.0	0.28	0.001	10.0	
	Single	30.0	0.14	0.001	10.0	
AAB841-SE□ Input	Dual	7.5	15.0 µA	0.146	2.4	
	Single	7.5	7.5 µA	0.074	4.8	
AAT141-SE□	Dual	0.18	0.5	2.43	2.1	
	Single	0.18	0.25	2.43	2.1	
AAB141-HE□	Dual	24.0	26.3	0.146	2.4	Current input
	Single	24.0	26.3	0.074	4.8	Current input
AAB141-HE□	Dual	7.5	15.0 µA	0.146	2.4	Voltage input
	Single	7.5	7.5 µA	0.074	4.8	Voltage input
AAB842-HE□ Input	Dual	24.0	26.3	0.146	2.4	Current input
	Single	24.0	26.3	0.074	4.8	Current input
AAB842-HE□ Input	Dual	7.5	15.0 µA	0.146	2.4	Voltage input
	Single	7.5	7.5 µA	0.074	4.8	Voltage input
ADV157-SE□	Single	30.0	5.5	0.11	0	
ADV151-PE□ ADV151-PF□	Dual	30.0	11.0	0.001	10.0	
	Single	30.0	5.5	0.001	10.0	
ADV161-PE□	Dual	30.0	6.7	0.001	10.0	
	Single	30.0	3.4	0.001	10.0	
ADV141-PE□	—	—	—	—	—	Non-compliant (*2)
ADV557-SE□	Single	26.4	100.0	0.138	0	

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).

*2: All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

Table FIO Parameters (The Load Devices) (2/2)

Module name		Vmax (V)	Imax (mA)	Ci (µF)	Li (µH)	Remarks (*1) (mode, terminals)
ADV551-PE□ ADV551-PF□	Dual	26.4	100.0	0.28	10.0	Without surge absorber Contact output mode
	Single	26.4	100.0	0.14	10.0	Contact output mode
ADV561-PE□	Dual	26.4	100.0	0.275	0	Contact output mode
	Single	26.4	100.0	0.138	0	Contact output mode
ADR541-PE□	Dual	26.4	100.0	160.0 pF	0	When DC is impressed.
		110 .0	14.0	160.0 pF	0	When DC is impressed.
	Single	26.4	100.0	80.0 pF	0	When DC is impressed.
		110 .0	14.0	80.0 pF	0	When DC is impressed.
AAT145-SE□	Dual	5.0	1.0	0.0015	12.6	TC/mV input
	Single	5.0	1.0	0.0010	12.6	TC/mV input
ALF111-SE□	Dual	-	-	-	-	(*3)
	Single	-	-	-	-	(*3)
EB401-E□		10.0	0.9 µA	8.0 pF	0.1	With terminating resistance 50 Ω
ANT401-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
ANT411-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
ANT421-E□	Dual	—	—	—	—	(*2)
	Single	—	—	—	—	(*2)
AEPV7D-1□E AEPV7D-1□F	CN1 to CN7	—	—	—	—	
AEPV7D-4□E AEPV7D-4□F	CN1 to CN7	—	—	—	—	
A1BD5D-□E A1BD5D-□F	TM3	—	—	—	—	Ready input (*2)
		60	20	0	0	Ready input DC

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).
*2: All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.
*3: Use a barrier for fieldbus as field wiring terminal for CSA NI (example: KLD2-PR-Ex1.IEC1).

Table Cable Parameter

Model	Lc (µH/m)	Cc (pF/m)
YCB141	0.25	100
YCB301 (*1)	—	—
YCB311	0.22	85
KS1	1.50	110
KS2	1.50	110
KS8	1.50	110
KS9	1.50	110
AKB331	1.50	110
AKB332	2.20	100
AKB334	2.20	100
AKB335	1.50	110
AKB336	0.67	55
AKB337	1.50	110

*1: All wiring shall comply with Canadian Electrical Code Part I and Local Electrical Codes.

RIO

The list of the appropriate I/O modules, electrical transceiver, optical transceiver, and the parameters are as follows.
The appropriate products are source devices.

Table RIO Parameters (The Source Devices)

Module name	Voc (V)	Isc (mA)	Ca (μF)	La (mH)	Vn (V)	In (mA)	Cn (μF)	Ln (mH)	Remarks (*1)
AAM10	25.5	35.0	0.20	4.0	25.5	22.0	0.20	100.0	
AAM11	25.5	60.0	0.27	5.0	25.5	22.0	0.27	100.0	
AAM11B	25.5	60.0	0.27	5.0	25.5	22.0	0.27	100.0	
AAM21 AAM21J	3.0	1.5	1.00	20.0	1.5	1.0	1.00	100.0	RTD input
APM11	26.4	40.0	0.15	2.0	26.4	35.0	0.15	50.0	
AAM50	25.5	21.5	0.20	2.0	25.5	21.5	0.20	100.0	
AAM51	25.5	21.5	0.20	4.0	25.5	21.5	0.20	100.0	Current input mode
AAM51	10.3	60.0	0.20	4.0	10.3	10.0	0.20	100.0	Voltage mode
AMC80	25.5	21.5	0.20	1.6	25.5	21.5	0.20	100.0	Current output
AMC80	14.0	0.1	1.00	20.0	14.0	0.1	1.00	100.0	Voltage input
AMM12	14.0	0.1	1.00	20.0	14.0	0.1	1.00	100.0	
AMM22 AMM22J	14.0	0.1	1.00	20.0	14.0	0.1	1.00	100.0	TC/mV input
AMM32 AMM32J	6.0	1.5	1.00	20.0	1.5	1.5	1.00	100.0	RTD input
AMM42	24.5	60.0	0.27	0.8	24.5	22.0	0.27	100.0	
AMM52	25.5	21.5	0.27	1.6	25.5	21.5	0.27	100.0	
ADM11 ADM12	6.0	20.0	1.00	10.0	6.0	20.0	1.00	100.0	
ADM51 ADM52	Non-compliant (because energy is not supplied to NI equipment external wiring).								
ADM15R	25.5	8.5	0.20	2.0	25.5	8.5	0.20	100.0	
ADM55R	Non-compliant (because energy is not supplied to NI equipment external wiring).								
ACM11	22.0	40.0	0.05	0.5	19.5	15.0	0.10	10.0	V input
ACM12	4.7	67.0	1.00	0.8	4.7	40.0	1.00	10.0	
ACF11	20.0	150.0	0.18	0.1	20.0	80.0	0.18	5.0	
RB401	13.0	140.0	0.27	10.0	5.0	90.0	1.00	1.0	With terminating resistance 107 Ω (*2)
AIP511	13.0	140.0	0.27	10.0	5.0	90.0	1.00	1.0	
AIP512	13.0	140.0	0.27	10.0	5.0	90.0	1.00	1.0	
AIP581	13.0	140.0	0.27	10.0	5.0	90.0	1.00	1.0	

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).
*2: RB401, AIP511, AIP512, and AIP581 can be connected in parallel each other without any regard for the order.
Those can be connected, up to a maximum of 9 products, and their cables can be extended, up to a maximum of 750 m.

The appropriate products are load devices which received energy from CSA NI equipments.

Table RIO Parameters (The Load Devices)

Module name	Vmax (V)	Imax (mA)	Ci (µF)	Li (µH)	Remarks (*1)
AAM10	11.0	40.0	0.015	10.0	Current input mode, B-C
AAM10	30.0	1.0	0.015	10.0	Voltage input mode, B-C
AAM11	11.0	40.0	0.015	10.0	Current input mode, B-C
AAM11	30.0	1.0	0.015	10.0	Voltage input mode, B-C
AAM11B	11.0	40.0	0.015	10.0	Current input mode, B-C
AAM11B	30.0	1.0	0.015	10.0	Voltage input mode, B-C
AAM21 AAM21J	4.0	1.0	0.150	10.0	TC/mV input mode, B-C
APM11	26.4	24.0	0.010	10.0	Contact input mode, B-C
AMC80	30.0	1.0	0.001	10.0	Voltage input
AMM12	30.0	1.0	0.010	10.0	Voltage input mode
AMM22 AMM22J	4.0	1.0	0.010	10.0	TC/mV input mode
AMM32 AMM32J	5.2	1.1	0.010	10.0	RTD input mode
ADM11 ADM12	25.0	1.0	0.001	100.0	Contact input mode, A-B
ADM51 ADM52	30.0	100.0	0.001	10.0	Transistor contact mode
ADM55R	25.0	100.0	0.001	10.0	Relay output mode
	130.0	12.0	0.001	10.0	
ACM11	15.0	5.0	0.010	100.0	
ACM12	14.0	5.0	0.010	100.0	
RB401	20.0	80.0	0.001	8.0 mH	Terminating resistance (107 Ω) (*2)
AIP511	20.0	70.0	0.001	8.0 mH	
AIP512	20.0	80.0	0.001	8.0 mH	
AIP581	20.0	80.0	0.001	8.0 mH	

*1: Without any mode name in the appropriate remarks column, All parameters are valid for any operation mode of the module (type name).

*2: RB401, AIP511, AIP512, and AIP581 can be connected in parallel each other without any regard for the order.
Those can be connected, up to a maximum of 9 products, and their cables can be extended, up to a maximum of 750 m.

Table Cable Parameters

Model	Lc (µH/m)	Cc (pF/m)
YCB121	0.92	85
KS1	1.50	110
KS2	1.50	110
KS8	1.50	110
KS9	1.50	110

Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters

The List of FM NI Compliant Products

Table The List of FM NI Compliant Products (1/3)

Classifications	Type names	Products
Field control unit	AFV10S-S□1□E1 AFV10S-S□1□F1 (*1)	Field Control Unit (for Vnet/IP)
	AFV10D-S41□E1 AFV10D-S41□F1 (*1)	Duplexed Field Control Unit (for Vnet/IP)
	AFV30S-S□1□E1 AFV30S-S□1□F1 (*1)	Field Control Unit (for Vnet/IP)
	AFV30D-S41□E1 AFV30D-S41□F1 (*1)	Duplexed Field Control Unit (for Vnet/IP)
Node unit	ANB10S-□□E ANB10S-□□F ANB10S-□□G	Node Unit for Single ESB Bus
	ANB10D-4□E ANB10D-4□F ANB10D-4□G	Node Unit for Dual-Redundant ESB Bus
	ANB11S-□□E ANB11S-□□F	Node Unit for Single ESB Bus with Optical Repeater
	ANB11D-□□E ANB11D-□□F	Node Unit for Dual-Redundant ESB Bus with Optical Repeater
	ANR10S-□□E ANR10S-□□F	Node Unit for Single ER Bus
	ANR10D-4□E ANR10D-4□F	Node Unit for Dual-Redundant ER Bus
	ANR11S-□□E ANR11S-□□F	Node Unit for Single ER Bus
	ANR11D-4□E ANR11D-4□F	Node Unit for Dual-Redundant ER Bus
Unit	ANT10U-□□E ANT10U-□□F	Unit for Optical ESB Bus Repeater Module
Router	AW810D-A2□0□E AW810D-A2□0□F	Wide Area Communication Router
Processor module	CP451-E□	Processor module
	CP461-E□	Processor module
Communication module	VI461-2E□	Communication module
Power supply module	PW441-E□	100 V AC power supply module
	PW442-E□	200 V AC power supply module
	PW444-E□	24 V DC power supply module
	PW481-E□	100 V AC power supply module
	PW482-E□ (*2)	220 V AC power supply module
	PW484-E□	24 V DC power supply module
Bus interface module	SB401-E□	ESB bus interface slave module
	EB501-E□	ER bus interface slave module
	EB511-E□	ER bus interface slave module
	ANT502-E□	Optical ESB Bus Repeater Slave Module
	ANT512-E□	Optical ESB Bus Repeater Slave Module
	ANT522-E□	Optical ESB Bus Repeater Slave Module (for Multimode Fiber)

Note: Any accessories for maintenance are FM NI approved products.

*1: AFV30S/AFV30D and AFV10S/AFV10D (FCU for Vnet/IP) requires L2 switch to connect to a network.
For L2 switch, select and use one that can be installed at Class I, Division 2 area and conforms to FM NI or UL1604.

*2: The AC mains circuit (220-240 V AC) supplying power to 220-240 V AC power supplies must be supplied by a Neutral-Referenced Supply Circuit.

Table The List of FM NI Compliant Products (2/3)

Classifications	Type names	Products
I/O module	AAI143-□E□	Analog input module (4 to 20 mA, 16 points, whole insulation)
	AAI543-□E□ AAI543-□F□	Analog output module (4 to 20 mA, 16 points, whole insulation)
	AAV144-SE□	Analog input module (-10 to +10 V, 16 points, whole insulation)
	AAV544-SE□	Analog output module (-10 to +10 V, 16 points, whole insulation)
	AAI135-□E□	Analog input module (4 to 20 mA, 8 points, individual insulation)
	AAI835-□E□	Analog I/O module (4 to 20 mA, 4 points input /4 points output, individual insulation)
	AAP135-SE□	Pulse input module (0 to 10 kHz, 8 points, individual insulation)
	AAT145-SE□	Thermocouple/mV input module (16 points, individual insulation)
	AAR145-SE□	RTD/slide rheostat input module (16 points, individual insulation)
	ADV151-PE□ ADV151-PF□	Digital input module (32 points, pulse-count function)
	ADV551-PE□ ADV551-PF□	Digital output module (32 points, pulse with output function)
	ADV161-PE□	Digital input module (64 points, pulse-count function)
	ADV561-PE□	Digital output module (64 points, pulse-count function)
	ALR111-SE□	RS-232C communication module (2-port, 1200 bps to 115.2 kbps)
	ALR121-SE□	RS-422/RS-485 serial communication module (2-port, 1200 bps to 115.2 kbps)
	ALE111-SE□	Ethernet communication module
	ALF111-SE□	Foundation Fieldbus (FF-H1) communication module
	ADCV01	Dummy cover
Terminal block	ATA4S	Single press-tightening terminal block for analog
	ATB5S	Single press-tightening terminal block for digital input
	ATD5S	Single press-tightening terminal block for digital output
	ATI3S	Single press-tightening terminal block for analog individual insulation
	ATF9S	Press-tightening terminal block for Foundation Fieldbus
	ATA4D	Duplicated press-tightening terminal block for analog
	ATB5D	Duplicated press-tightening terminal block for digital input
	ATD5D	Duplicated press-tightening terminal block for digital output
	ATI3D	Duplicated press-tightening terminal block for analog individual insulation
	ATK4A	KS cable interface adapter (for analog)
	ATI3A	KS cable interface adapter (for AAI135, AAP135)
	ATB3A	KS cable interface adapter (for AAI835)
	ATD5A	KS cable interface adapter (for digital)
Terminal board	AEA3D-0E AEA3D-0F	Analog/single, Duplicated terminal board (8 points x 4)
	AEA4D-0E AEA4D-0F	Analog/single, Duplicated terminal board (16 points x 2 or 8 points x 2)
	A1BA4D-0E A1BA4D-0F	Terminal Board for Analog (16 points x 1 or 8 points x 1)
	AET4D-0E AET4D-0F	Thermocouple/single, Duplicated terminal board (16 points x 2)
	A1BT4D-0E A1BT4D-0F	Terminal Board for Tehrmocouple (16 points x 1)
	AER4D-0E AER4D-0F	RTD/ slide rheostat single, duplicated terminal board (16 points)
	A1BR4D-0E A1BR4D-0F	Terminal Board for RTD input (16 points x 1)
	AED5D-0E AED5D-0F	Digital/single, duplicated terminal board (32 points x 2)
	A1BD5D-0E A1BD5D-0F	Terminal Board for Digital (32 points x 1)

Note: Any accessories for maintenance are FM NI approved products.

Table The List of FM NI Compliant Products (3/3)

Classifications	Type names	Products
Terminal board	AEF9D-0E AEF9D-0F	Fieldbus/single, duplicated terminal board
Bus cable	YCB301	ESB bus cable
	YCB141	ER bus cable
	YCB311	ER bus extension cable
	YCB147-E YCB147-F	ER bus cable conversion adaptor
	YCB138	Fieldbus terminator
Signal cable	AKB331	Signal cable (between ADV151, ADV551 and terminal board)
	AKB335	Signal cable (for connection between AAR145 and AER4D)
	AKB336	Signal cable (between ALF111 and terminal board)
	AKB337	Signal cable (between ADV161, ADV561 and terminal board)
	KS1	Signal cable
	AKB131	RS-232C cable(for connection between ALR111and Modem)
	AKB132	RS-232C cable(for connection between ALR111and RS-232C Device)
	AKB133	RS-232C cable(for connection between ALR111and FA-M3)
	AKB134	RS-232C cable(for connection between ALR111and RS-232C Device)
	AKB135	RS-232C cable(for connection between ALR111 and Modem)
	AKB136	RS-232C cable(for connection between ALR111 and RS-232C Device)
	AKB161	RS-422/RS-485 cable (for connection between ACM12 and FA500)
	AKB162	RS-422/RS-485 cable (for connection between ACM12 and YS)
I/O module	EB401-E□	ER bus interface master module
	EB402-E□	ER bus interface master module
	EC401-E□	ESB bus coupler module
	EC402-E□	ESB Bus Coupler Module
	ANT401-E□	Optical ESB Bus Repeater Master Module
	ANT411-E□	Optical ESB Bus Repeater Master Module
	ANT421-E□	Optical ESB Bus Repeater Master Module (for Multimode Fiber)
Distribution unit	AEP7D-□E AEP7D-□F	Primary distribution unit
	AEPV7D-□□E AEPV7D-□□F	Power Supply Bus Unit, Vertical Type
	AEP9D-4E AEP9D-4F	Secondary distribution unit

Note: Any accessories for maintenance are FM NI approved products.

Parameters of FM NI Compliant Equipments

The table below shows the list of source devices for FM NI equipments.

Table FIO Parameters (The Source Devices) (1/2)

Module name		Voc (V)	Isc (mA)	Ca (μF)	La (mH)	Remarks (*1)
AFV10S-S□1□E1 AFV10S-S□1□F1	TM1	—	—	—	—	(*2)
AFV10D-S41□E1 AFV10D-S41□F1	TM1	—	—	—	—	(*2)
AFV30S-S□1□E1 AFV30S-S□1□F1	TM1	—	—	—	—	(*2)
AFV30D-S41□E1 AFV30D-S41□F1	TM1	—	—	—	—	(*2)
AW810D-A2□0□E AW810D-A2□0□F	–	—	—	—	—	(*2)
CP451-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
CP461-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
VI461-2E□	Redundant	—	—	—	—	(*2)
SB401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EB501-E□	Redundant	9.4	45.0	0.39	0.46	With terminator resister 50Ω
	Single	9.4	45.0	0.39	0.46	
EB511-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT502-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT512-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT522-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
AAI143-□E□	Redundant	25.5	24.4	0.19	10.0	2-wire transmitter input
	Single	25.5	24.4	0.19	10.0	
AAI543-□E□ AAI543-□F□	Redundant	24.3	23.0	0.19	10.0	
	Single	24.3	23.0	0.19	10.0	
AAV544-SE□	Redundant	11.8	12.5	0.27	20.0	
	Single	11.8	12.5	0.4	20.0	
AAI135-□E□	Redundant	29.3	31.0	0.12	10.0	2-wire transmitter input
	Single	29.3	31.0	0.12	10.0	
AAI835-□E□ Input	Redundant	29.3	31.0	0.12	10.0	2-wire transmitter input
	Single	29.3	31.0	0.12	10.0	
AAI835-□E□ Output	Redundant	29.3	23.0	0.12	10.0	
	Single	29.3	23.0	0.12	10.0	
AAP135-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
AAT145-SE□	Redundant	5.0	0.5	1.0	20.0	RJC input
	Single	5.0	0.5	1.0	20.0	
	Redundant	16.5	33.4	0.3	0.8	Power supply for RJC
	Single	16.5	16.7	0.3	0.8	
	Redundant	16.5	33.0	0.3	0.8	Cable coming out detection
	Single	16.5	16.5	0.3	0.8	

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: Wirings must comply with NEC (National Electrical Code: ANSI/NFPA-70) or the regulations of the relevant country.

Table FIO Parameters (The Source Devices) (2/2)

Module name		Voc (V)	Isc (mA)	Ca (μF)	La (mH)	Remarks (*1)
AAR145-SE□	Redundant	5.0	1.1	1.0	20.0	RTD/POT input
	Single	5.0	1.1	1.0	20.0	
	Redundant	26.4	52.8	0.3	0.8	Cable coming out detection
	Single	26.4	26.4	0.3	0.8	
ADV151-PE□ ADV151-PF□	Redundant	—	—	—	—	Contact input mode (*2)
	Single	—	—	—	—	
ADV551-PE□ ADV551-PF□	Redundant	—	—	—	—	Voltage output mode(*2)
	Single	—	—	—	—	
ADV161-PE□	Redundant	—	—	—	—	Contact input mode(*2)
	Single	—	—	—	—	
ADV561-PE□	Redundant	—	—	—	—	Voltage output mode(*2)
	Single	—	—	—	—	
ALR111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALR121-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALE111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALF111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EB401-E□	Redundant	9.4	45.0	0.39	0.46	With terminator resister 50Ω
	Single	9.4	45.0	0.39	0.46	
EB402-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EC401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EC402-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT411-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT421-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
AEP7D-□E AEP7D-□F	CN1 to CN14	—	—	—	—	(*2)
AEPV7D-□□E AEPV7D-□□F	CN1 to CN7	—	—	—	—	(*2)
AEP9D-4E AEP9D-4F	CN1 to CN18	—	—	—	—	(*2)

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: Wirings must comply with NEC (National Electrical Code: ANSI/NFPA-70) or the regulations of the relevant country.

The table below shows the list of load devices receive energy from FM NI equipments.

Table FIO Parameters (The Load Devices) (1/2)

Module name		Vmax (V)	Imax (mA)	Ci (μF)	Li (μH)	Remarks (*1)
AFV10S-S□1□E1 AFV10S-S□1□F1	TM2	—	—	—	—	(*2)
AFV10D-S41□E1 AFV10D-S41□F1	TM2	—	—	—	—	(*2)
AFV30S-S□1□E1 AFV30S-S□1□F1	TM2	—	—	—	—	(*2)
AFV30D-S41□E1 AFV30D-S41□F1	TM2	—	—	—	—	(*2)
AW810D-A2□0□E AW810D-A2□0□F	–	—	—	—	—	(*2)
CP451-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
CP461-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
VI461-2E□	Redundant	—	—	—	—	(*2)
PW441-E□	Redundant	—	—	—	—	(*2)
PW442-E□	Redundant	—	—	—	—	(*2)
PW444-E□	Redundant	—	—	—	—	(*2)
PW481-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
PW482-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
PW484-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
SB401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EB501-E□	Redundant	10.0	0.9 μA	8.0 pF	0.1	With terminator resister 50Ω
	Single	10.0	0.9 μA	8.0 pF	0.1	
EB511-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT502-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT512-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT522-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
AAI143-□E□	Redundant	25.5	26.3	7000 pF	10.0	4-wire transmitter input
	Single	25.5	26.3	3500 pF	10.0	
AAV144-SE□	Redundant	30.0	0.28	0.001	10.0	When power is turned on, Rin = 1 MΩ or more (*3)
	Single	30.0	0.14	0.001	10.0	
AAI135-□E□	Redundant	24.0	31.0	5000 pF	10.0	4-wire transmitter input
	Single	24.0	31.0	5000 pF	10.0	
AAI835-□E□ Input	Redundant	24.0	31.0	5000 pF	10.0	4-wire transmitter input
	Single	24.0	31.0	5000 pF	10.0	
AAP135-SE□	Redundant	26.4	30.0	5000 pF	10.0	
	Single	26.4	30.0	5000 pF	10.0	
AAT145-SE□	Redundant	5.0	1.0	0.0015	12.6	TC/mV input
	Single	5.0	1.0	0.001	12.6	

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: Wirings must comply with NEC (National Electrical Code: ANSI/NFPA-70) or the regulations of the relevant country.
*3: Since the parameters such as Imax are calculated according to the internal impedance (Imax=Vmax/Rin), the case of Isc ≤ Imax in “How to compare parameters” in “3.1.2 FM Non-Incendiv “ is omissible.
Make sure that the target equipment can be connected with this module has Rin : internal impedance described in remarks column.

Table FIO Parameters (The Load Devices) (2/2)

Module name		Vmax (V)	Imax (mA)	Ci (μF)	Li (μH)	Remarks (*1)
ADV151-PE□ ADV151-PF□	Redundant	30.0	11.0	0.001	10.0	Voltage input mode, Rin = 5.6 kΩ (*3)
	Single	30.0	5.5	0.001	10.0	
ADV551-PE□ ADV551-PF□	Redundant	26.4	100.0	0.28	10.0	ON/OFF status output mode, Without surge absorber
	Single	26.4	100.0	0.14	10.0	ON/OFF status output mode
ADV161-PE□	Redundant	30.0	6.7	0.001	10.0	Voltage input mode, Rin = 9.1 kΩ (*3)
	Single	30.0	3.4	0.001	10.0	
ADV561-PE□	Redundant	26.4	100.0	0.275	0	ON/OFF status output mode
	Single	26.4	100.0	0.138	0	
ALR111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALR121-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALE111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ALF111-SE□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EB401-E□	Redundant	10.0	0.9 μA	8.0 pF	0.1	With terminator resister 50 Ω
	Single	10.0	0.9 μA	8.0 pF	0.1	
EB402-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EC401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
EC402-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT401-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT411-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
ANT421-E□	Redundant	—	—	—	—	(*2)
	Single	—	—	—	—	
AEP7D-□E AEP7D-□F	TM1,TM2	—	—	—	—	(*2)
AEPV7D-□□E AEPV7D-□□F	TM1	—	—	—	—	(*2)
AEP9D-4E AEP9D-4F	TM1,TM2	—	—	—	—	(*2)
A1BD5D-□E A1BD5D-□F	TM3	—	—	—	—	Ready input(*2)
		60	20	0	0	Ready input DC

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: Wirings must comply with NEC (National Electrical Code: ANSI/NFPA-70) or the regulations of the relevant country.
*3: Since the parameters such as Imax are calculated according to the internal impedance (Imax=Vmax/Rin), the case of Isc ≤ Imax in “How to compare parameters” in “3.1.2 FM Non-Incendiv “ is omissible.
Make sure that the target equipment can be connected with this module has Rin : internal impedance described in remarks column.

Table Cable Parawmeters

Module	Lc (μH/m)	Cc (pF/m)	Remark (*1)
YCB301	—	—	(*2)
YCB141	0.25	100.0	
YCB311	0.22	85.0	
KS1	1.5	110.0	
AKB331	1.5	110.0	
AKB335	1.5	110.0	
AKB336	0.67	55.0	
AKB337	1.5	110.0	
AKB131	—	—	(*2)
AKB132	—	—	(*2)
AKB133	—	—	(*2)
AKB134	—	—	(*2)
AKB135	—	—	(*2)
AKB136	—	—	(*2)
AKB161	—	—	(*2)
AKB162	—	—	(*2)

*1: Without any mode name in the appropriate remarks column, these parameters are valid for any operation mode of the module (type name).
*2: Wirings must comply with NEC (National Electrical Code: ANSI/NFPA-70) or the regulations of the relevant country.

Appendix 2. Lists of Type “n” Compliant Product

The List of Type “n” Compliant Products

Table The List of Type “n” Compliant Products (1/4)

Classifications	Type names	Products
Field control unit	AFV10S-S□14E1 AFV10S-S□14F1 (*1)	Field Control Unit (for Vnet/IP) (24 V DC power supply)
	AFV10D-S414E1 AFV10D-S414F1 (*1)	Duplexed Field Control Unit (for Vnet/IP) (24 V DC power supply duplication)
	AFV30S-S□14E1 AFV30S-S□14F1 (*1)	Field Control Unit (for Vnet/IP) (24 V DC power supply)
	AFV30D-S414E1 AFV30D-S414F1 (*1)	Duplexed Field Control Unit (for Vnet/IP) (24 V DC power supply duplication)
Node unit	ANB10S-□4E ANB10S-□4F ANB10S-□4G	Node Unit for Single ESB Bus (24 V DC power supply)
	ANB10D-44E ANB10D-44F ANB10D-44G	Node Unit for Dual-Redundant ESB Bus (24 V DC power supply duplication)
	ANB11S-□4E ANB11S-□4F	Node Unit for Single ESB Bus with Optical Repeater (24 V DC power supply)
	ANB11D-□4E ANB11D-□4F	Node Unit for Dual-Redundant ESB Bus with Optical Repeater (24 V DC power supply duplication)
	ANR10S-□4E ANR10S-□4F	Node unit for ER bus single (24 V DC power supply)
	ANR10D-44E ANR10D-44F	Node unit for ER bus duplication (24 V DC power supply duplication)
	ANR11S-□4E ANR11S-□4F	Node Unit for Single ER Bus (24 V DC power supply)
	ANR11D-44E ANR11D-44F	Node Unit for Dual-Redundant ER Bus (24 V DC power supply duplication)
Unit	ANT10U-□4E ANT10U-□4F	Unit for Optical ESB Bus Repeater Module (24 V DC power supply)
Router	AW810D-A2□04E AW810D-A2□04F	Wide Area Communication Router
Processor module	CP451-E□	Processor module
	CP461-E□	Processor module
Communication module	VI461-2E□	Communication module
Power supply module	PW444-E□	24 V DC power supply module
	PW484-E□	
Bus Interface module	SB401-E□	ESB bus interface slave module
	EB501-E□	ER bus interface slave module
	EB511-E□	ER bus interface slave module
	ANT502-E□	Optical ESB Bus Repeater Slave Module
	ANT512-E□	Optical ESB Bus Repeater Slave Module
	ANT522-E□	Optical ESB Bus Repeater Slave Module (for Multimode Fiber)

Note: Any accessories for maintenance are Type “n” compliant products.
*1: AFV30S/AFV30D and AFV10S/AFV10D (FCU for Vnet/IP) requires L2 switch to connect to a network. For L2 switch, select and use one that can be installed at Zone 2 area and conforms to type “n”.

Table The List of Type “n” Compliant Products (2/4)

Classifications	Type names	Products
I/O module	AAI141-□E□	Analog input module (4 to 20 mA, 16 points, non-insulation)
	AAI135-□E□	Analog input module (4 to 20 mA, 8 points, individual insulation)
	AAV141-SE□	Analog input module (1 to 5 V, 16 points, non-insulation)
	AAV142-SE□	Analog input module (-10 to +10 V, 16 points, non-insulation)
	AAB141-HE□	Analog input module (1 to 5 V / 4 to 20 mA, 16-channel, non-isolated)
	AAI841-□E□	Analog I/O module (4 to 20 mA, 8 points input/4 points output, non-insulation)
	AAB841-SE□	Analog I/O module (1 to 5 V input, 4 to 20 mA output, 8 points input/ 8 points output, non-insulation)
	AAB842-HE□	Analog I/O module (1 to 5 V / 4 to 20 mA input, 4 to 20 mA output, 8-channel input / 8-channel output, non-isolated)
	AAI835-□E□	Analog I/O module (4 to 20mA, 4 points input/4 points output, individual insulation)
	AAV542-SE□	Analog output module (-10 to +10V, 16 points, non-insulation)
	AAT141-SE□	Thermocouple/mV input module (16 points, whole insulation)
	AAR181-SE□	RTD input module (12 points, whole insulation)
	AAT145-SE□	Thermocouple/mV input module (16 points, individual insulation)
	AAR145-SE□	RTD/slide rheostat input module (16 points, individual insulation)
	AAP135-SE□	Pulse input module (0 to 10 kHz, 8 points, individual insulation)
	AAI143-□E□	Analog input module (4 to 20 mA, 16 points, whole insulation)
	AAI543-□E□ AAI543-□F□	Analog output module (4 to 20 mA, 16 points, whole insulation)
	AAV144-SE□	Analog input module (-10 to +10V, 16 points, whole insulation)
	AAV544-SE□	Analog output module (-10 to +10V, 16 points, whole insulation)
	ADV157-SE□	Digital input module (32 points, for press-tightening terminal only)
	ADV151-□E□ ADV151-□F□	Digital input module (32 points, with pulse-count function)
	ADV161-PE□	Digital input module (64 points, with pulse-count function)
	ADV557-SE□	Digital output module (32 points, for press-tightening terminal only)
	ADV551-PE□ ADV551-PF□	Digital output module (32 points, with pulse width output function)
	ADV561-PE□	Digital output module (64 points, with pulse-count function)
	ALR111-SE□	RS-232C communication module (2-port, 1200 bps to 115.2 kbps)
	ALR121-SE□	RS-422/RS-485 serial communication module (2-port, 1200 bps to 115.2 kbps)
	ALE111-SE□	Ethernet communication module
	ALF111-SE□	Foundation Fieldbus (FF-H1) communication module
	ADCV01	Dummy cover
Terminal block	ATA4D	Duplicated press-tightening terminal block for analog
	ATT4D	Duplicated press-tightening terminal block for thermocouple/mV
	ATR8D	Duplicated press-tightening terminal block for RTD
	ATB5D	Duplicated press-tightening terminal block for digital input
	ATD5D	Duplicated press-tightening terminal block for digital output
	ATI3D	Duplicated press-tightening terminal block for analog individual insulation
	ATA4S	Single press-tightening terminal block for analog
	ATT4S	Single press-tightening terminal block for thermocouple/mV
	ATR8S	Single press-tightening terminal block for RTD
	ATB5S	Single press-tightening terminal block for digital input
	ATD5S	Single press-tightening terminal block for digital output
	ATI3S	Single press-tightening terminal block for analog individual insulation
	ATC5S	Press-tightening terminal block for digital (for ADV157, ADV557)
	ATF9S	Press-tightening terminal block for Foundation Fieldbus

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.

Table The List of Type “n” Compliant Products (3/4)

Classifications	Type names	Products
Terminal board	ATK4A	KS cable interface adaptor (for analog)
	ATI3A	KS cable interface adaptor (for AAI135, AAP135)
	ATB3A	KS cable interface adaptor (for AAI835)
	ATD5A	KS cable interface adaptor (for digital)
	ATM4A	KS cable interface adaptor (for MAC2 compatible)
	ATV4A	KS cable interface adaptor (for VM2 compatible)
	AEA3D-0E AEA3D-0F	Analog/single, duplicated terminal board (8 points x 4)
	AEA4D-0E AEA4D-0F	Analog/single, duplicated terminal board (16 points x 2, or 8 points x 2)
	A1BA4D-0E A1BA4D-0F	Terminal Board for Analog (16 points x 1, or 8 points x 1)
	AET4D-0E AET4D-0F	Thermocouple/single, duplicated terminal board (16 points x 2)
	A1BT4D-0E A1BT4D-0F	Terminal Board for Thermocouple (16 points x 1)
	AED5D-0E AED5D-0F	Digital/single, duplicated terminal board (32 points)
	A1BD5D-0E A1BD5D-0F	Terminal Board for Digital (32 points x 1)
	AEC4D-7E AEC4D-7F	Digital/single, duplicated terminal board (for relay output)
	AEF9D-0E AEF9D-0F	Fieldbus single, duplicated terminal board
	AER4D-0E AER4D-0F	RTD/single, duplicated terminal board
	A1BR4D-0E A1BR4D-0F	Terminal Board for RTD input (16 points x 1)
Bus cable (*1)	YCB301	ESB bus cable
	YCB141	ER bus cable
	YCB311	ER bus extension cable
	YCB147-E YCB147-F	ER bus cable conversion adaptor
	YCB138	Fieldbus terminator
Signal cable (*1)	AKB331	Signal cable (between ADV151, ADV551 and terminal board)
	AKB335	Signal cable (for connection between AAR145 and AER4D)
	AKB336	Signal cable (between ALF111 and terminal board)
	AKB337	Signal cable (between ADV161, ADV561 and terminal board)
	KS1	Signal cable
	AKB131	RS-232C cable (for connection between ALR111and Modem)
	AKB132	RS-232C cable (for connection between ALR111and RS-232C Device)
	AKB133	RS-232C cable (for connection between ALR111and FA-M3)
	AKB134	RS-232C cable (for connection between ALR111and RS-232C Device)
	AKB135	RS-232C cable (for connection between ALR111 and Modem)
	AKB136	RS-232C cable (for connection between ALR111 and RS-232C Device)
	AKB161	RS-422/RS-485 cable (for connection between ACM12 and FA500)
	AKB162	RS-422/RS-485 cable (for connection between ACM12 and YS)
I/O module	EB401-E☐	ER bus interface master module
	EB402-E☐	ER bus interface master module
	EC401-E☐	ESB bus coupler module
	EC402-E☐	ESB bus coupler module
	ANT401-E☐	Optical ESB Bus Repeater Master Module

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.
*1: The self-declaration of Type “n” is not applicable for cables.

Table The List of Type “n” Compliant Products (4/4)

Classifications	Type names	Products
I/O module	ANT411-E□	Optical ESB Bus Repeater Master Module
	ANT421-E□	Optical ESB Bus Repeater Master Module (for Multimode Fiber)
Distribution unit	AEP7D-4E AEP7D-4F	Primary distribution unit (for 24 V DC input)
	AEPV7D-4□E AEPV7D-4□F	Power Supply Bus Unit, Vertical Type
	AEP9D-4E AEP9D-4F	Secondary distribution unit

Note: For type names without the basic specification code in the table above, any products with basic specification codes are Type “n” compliant products. Also any accessories for maintenance are Type “n” compliant products.
*1: The self-declaration of Type “n” is not applicable for cables.

Appendix 3. Lists of Parameters of Modules with Built-in Barrier

Table List of Parameters (ATEX) of Modules with Built-in Barrier

Modules		Uo (V)	Io (mA)	Po (mW)	Ui (V)	Co (nF)			Lo (mH)			Remarks (*1)
						IIC	IIB	IIA	IIC	IIB	IIA	
ASI133-S00 ASI133-H00	Single	27.8	84	584	–	84	659	659	2	18	18	2Wire
		27.8	4	28	28	84	659	695	100	100	100	4Wire
	Redundant	27.8	93	647	–	84	659	659	1.2	14	14	2Wire
		27.8	7	49	28	84	659	659	100	100	100	4Wire
ASI533-S00	Single	27.8	86	598	–	84	659	659	1.8	17	17	
ASI533-H00	Redundant	27.8	93	647	–	84	659	659	1.2	14	14	
AST143-S00	Single	16.8	7	30	–	220	1730	8000	240	725	1930	No channel or one channel is connected to equipotential bonding.
		16.8	46	194	–	65	380	1550	5.6	22	44	Two channels up to all channels connected to equipotential bonding.
	Redundant	16.8	13	55	–	220	1730	8000	70	280	560	No channel or one channel is connected to equipotential bonding.
		16.8	92	387	–	65	380	1550	1.4	5.6	11	Two channels up to all channels connected to equipotential bonding.
ASR133-S00	Single	13.7	30	103	–	122	867	867	2.5	5	5	
	Redundant	13.7	60	206	–	94	714	714	1	5	5	
ASD143-P00	Single	9.8	21	52	–	1100	7600	11600	26	107	214	
	Redundant	9.8	41	101	–	1100	7600	11600	7	28	56	
ASD533-S00	Single	27.16	108.6	738	–	89	690	690	0.42	9.9	9.9	
	Redundant	27.16	108.6	738	–	89	690	690	0.42	9.9	9.9	

*1: These parameters are valid for the operation nodes of the corresponding modules if the model.

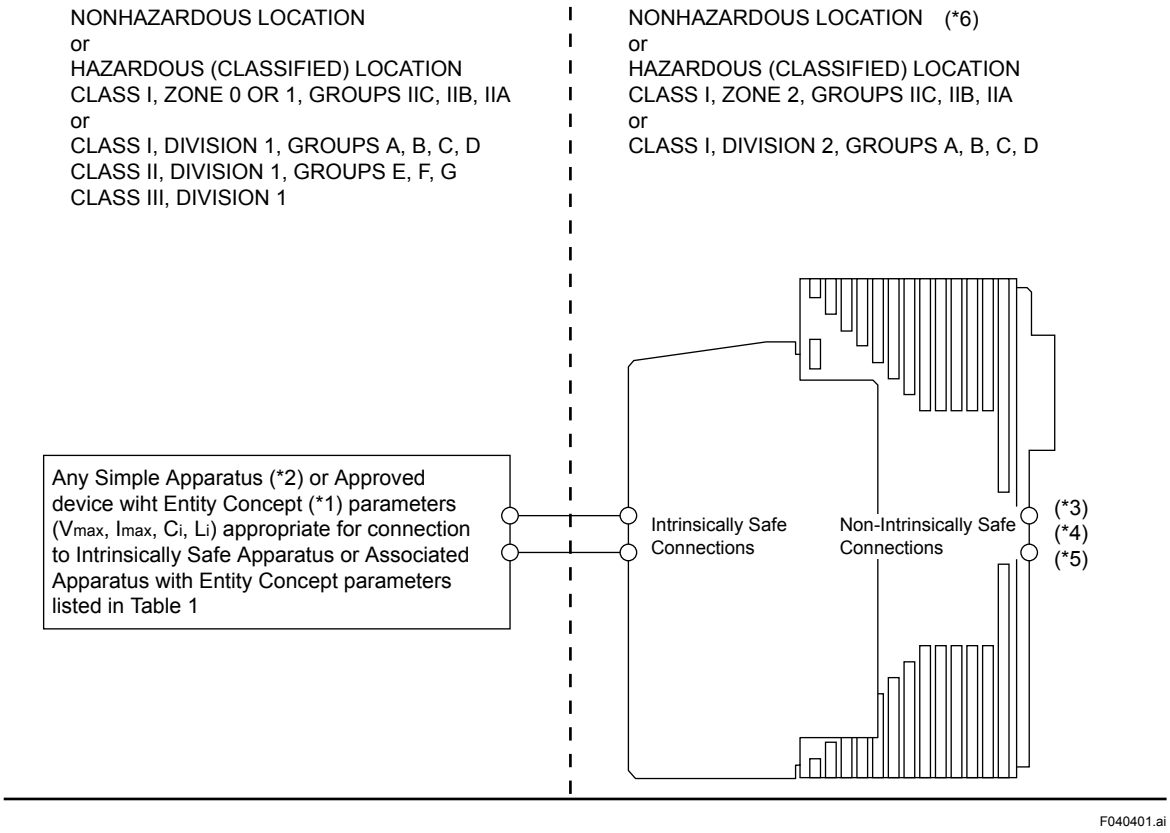
Table List of Parameters (FM) of Modules with Built-in Barrier

Modules		Voc (V)	Isc (mA)	Po (mW)	Vmax (V)	Ca (nF)			La (mH)			Remarks (*1)
						A,B	C,E	D,F,G	A,B	C,E	D,F,G	
ASI133-S00 ASI133-H00	Single	27.8	84	584	–	84	659	659	2	18	18	2Wire
		27.8	4	28	28	84	659	695	100	100	100	4Wire
	Redundant	27.8	93	647	–	84	659	659	1.2	14	14	2Wire
		27.8	7	49	28	84	659	659	100	100	100	4Wire
ASI533-S00	Single	27.8	86	598	–	84	659	659	1.8	17	17	
ASI533-H00	Redundant	27.8	93	647	–	84	659	659	1.2	14	14	
AST143-S00	Single	16.8	7	30	–	220	1730	8000	240	725	1930	No channel or one channel is connected to equipotential bonding.
		16.8	46	194	–	65	380	1550	5.6	22	44	Two channels up to all channels connected to equipotential bonding.
	Redundant	16.8	13	55	–	220	1730	8000	70	280	560	No channel or one channel is connected to equipotential bonding.
		16.8	92	387	–	65	380	1550	1.4	5.6	11	Two channels up to all channels connected to equipotential bonding.
ASR133-S00	Single	13.7	30	103	–	122	867	867	2.5	5	5	
	Redundant	13.7	60	206	–	94	714	714	1	5	5	
ASD143-P00	Single	9.8	21	52	–	1100	7600	11600	26	107	214	
	Redundant	9.8	41	101	–	1100	7600	11600	7	28	56	
ASD533-S00	Single	27.16	108.6	738	–	89	690	690	0.42	9.9	9.9	
	Redundant	27.16	108.6	738	–	89	690	690	0.42	9.9	9.9	

*1: These parameters are valid for the operation nodes of the corresponding modules if the model.

Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval

Doc. No.: IFM035-A09


NONHAZARDOUS LOCATION
or
HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, ZONE 0 OR 1, GROUPS IIC, IIB, IIA
or
CLASS I, DIVISION 1, GROUPS A, B, C, D
CLASS II, DIVISION 1, GROUPS E, F, G
CLASS III, DIVISION 1
NONHAZARDOUS LOCATION (*6)
or
HAZARDOUS (CLASSIFIED) LOCATION
CLASS I, ZONE 2, GROUPS IIC, IIB, IIA
or
CLASS I, DIVISION 2, GROUPS A, B, C, D
Any Simple Apparatus (*2) or Approved device wiht Entity Concept (*1) parameters (Vmax, Imax, Ci, Li) appropriate for connection to Intrinsically Safe Apparatus or Associated Apparatus with Entity Concept parameters listed in Table 1
Intrinsically Safe Connections
Non-Intrinsically Safe Connections
(*3)
(*4)
(*5)

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*1: The Entity Concept allows interconnection of intrinsically safe apparatus with associated apparatus not specially examined in combination as a system when the approved values V_{OC} (or V_t) and I_{SC} (or I_t) for the associated apparatus are less than or equal to V_{max} and I_{max} for the intrinsically safe apparatus and the approved values of C_a and L_a for the associated apparatus are greater than $C_i + C_{cable}$ and $L_i + L_{cable}$, respectively, for the intrinsically safe apparatus.

*2: Simple Apparatus: An electrical component or combination of components of simple construction with well defined electrical parameters that does not generate more than 1.5 volts, 100 milliamps and 25 milliwatts, or a passive component that does not dissipate more than 1.3 watts and is compatible with the intrinsic safety of the circuit in which it is used.

*3: Wiring methods must be in accordance with the National Electrical Code, ANSI/NFPA 70, Article 504 or 505. Additional installation information can be found in ANSI/ISA-RP 12.6

*4: Modules shall not be connected to any device which uses or generates internally any voltage in excess of 250 V unless the device has been determined to adequately isolate the voltage from the module.

*5: Connection of modules to ground is not required

*6: These modules are rated “Nonincendive”. If the modules are intended to be mounted in a Division 2 location, they must be installed in an enclosure meeting the requirements of ANSI/ISA S82. The enclosure may be installed in a Class I, Division 2, Group A, ,B, C or D or a Class I, Zone 2, Group IIC hazardous (classified) location. A temperature rating of T4 applies to all Nonincendive rated modules.

Table 1-Entity Parameters (1/2)

Module type	Terminals	V_{oc} (V)	I_{sc} (mA)	V_t (V)	I_t (mA)	Groups Ca (µF)			Groups La (mH)		
						A, B	C, E	D, F, G	A, B	C, E	D, F, G
ASD143-P00 ATSB4D-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18	9.8	41	--	--	1.1	7.6	11.6	7	28	56
ASD143-P00 ATSB4S-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18	9.8	21	--	--	1.1	7.6	11.6	26	107	214
ASD533-S00 ATSD3D-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.16	108.6	--	--	0.089	0.69	0.69	0.42	9.9	9.9
ASD533-S00 ATSD3S-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.16	108.6	--	--	0.089	0.69	0.69	0.42	9.9	9.9
ASI533-S00 ATSS3D-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.8	93	--	--	0.084	0.659	0.659	1.2	14	14
ASI533-S00 ATSS3S-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.8	86	--	--	0.084	0.659	0.659	1.8	17	17
ASI133-S00 ASI133-H00 ATSA3D-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.8	93	--	--	0.084	0.659	0.659	1.2	14	14
	B1_B2; B3_B4; B5_B6; B7_B8; B10_B11; B12_B 13; B14_B15; B16_B17	27.8	7	--	--	0.084	0.659	0.659	100	100	100
ASI133-S00 ASI133-H00 ATSA3S-0	A1_B1; A3_B3; A5_B5; A7_B7; A10_B10; A12_B 12; A14_B14; A16_B16	27.8	84	--	--	0.084	0.659	0.659	2	18	18
	B1_B2; B3_B4; B5_B6; B7_B8; B10_B11; B12_B 13; B14_B15; B16_B17	27.8	4	--	--	0.084	0.659	0.659	100	100	100
AST143-S00 ATST4D-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*1)	16.8	13	--	--	0.22	1.73	8	70	280	560
	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*2)	16.8	92	--	--	0.065	0.38	1.55	1.4	5.6	11

Table 1-Entity Parameters (2/2)

Module type	Terminals	V_{oc} (V)	I_{sc} (mA)	V_t (V)	I_t (mA)	Groups Ca (µF)			Groups La (mH)		
						A, B	C, E	D, F, G	A, B	C, E	D, F, G
AST143-S00 ATST4S-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*1)	16.8	7	--	--	0.22	1.73	8	240	725	1930
	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18 (*2)	16.8	46	--	--	0.065	0.38	1.55	5.6	22	44
ASR133-S00 ATSR3D-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18	13.7	60	--	--	0.094	0.714	0.714	1	5	5
ASR133-S00 ATSR3S-0	A1_B1; A2_B2; A3_B3; A4_B4; A6_B6; A7_B7; A8_B8; A9_B9; A10_B10; A11_B11; A12_B12; A13_B13; A15_B15; A16_B16; A17_B17; A18_B18	13.7	30	--	--	0.122	0.867	0.867	2.5	5	5

Note: The ambient operating temperature (Tamb) for the modules is –20 °C to 70 °C.
Note: When use for associated intrinsically apparatus complying FM approval (FM 3610), following Field Control Unit and Node unit using PW481-E1, PW482-E1, or PW484-E1 should be combinated.
AFV10D-S41□F1, AFV10S-S31□F1, AFV10S-S41□F1
AFV30D-S41□F1, AFV30S-S31□F1, AFV30S-S41□F1
ANB10D-4□F, ANB10S-3□F, ANB10S-4□F
ANB10D-4□G, ANB10S-3□G, ANB10S-4□G
ANB11D-2□F, ANB11D-4□F, ANB11D-6□F
ANB11S-1□F, ANB11S-2□F, ANB11S-3□F, ANB11S-4□F
ANB11S-5□F, ANB11S-6□F
ANR10D-4□F, ANR10S-3□F, ANR10S-4□F

*1: These values are valid if no one of the channels or only one of the channels is connected to earth.
*2: These values are valid if more than one channel is connected to earth.

Appendix 5. Example of Certificate

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

(1) **EC-TYPE-EXAMINATION CERTIFICATE**

(Translation)

(2) Equipment and Protective Systems intended for Use in Potentially Explosive Atmospheres - **Directive 94/9/EC**

(3) EC-type-examination Certificate Number:

PTB 03 ATEX 2074

(4) Equipment: Digital-Output-Module ASD533-*** and Terminal ATSD3*-*

(5) Manufacturer: Yokogawa Electric Corporation

(6) Address: 9-32, Nakacho 2-chome, Musashino-shi, Tokyo 180, Japan

(7) This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the documents therein referred to.

(8) The Physikalisch-Technische Bundesanstalt, notified body No. 0102 in accordance with Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres, given in Annex II to the Directive.

The examination and test results are recorded in the confidential report PTB Ex 03-23151

(9) Compliance with the Essential Health and Safety Requirements has been assured by compliance with:

EN 50014:1997 + A1 + A2 EN 50020:1994

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate

(11) This EC-type-examination Certificate relates only to the design, examination and tests of the specified equipment in accordance to the Directive 94/9/EC. Further requirements of the Directive apply to the manufacturing process and supply of this equipment. These are not covered by this certificate.

(12) The marking of the equipment shall include the following:

II (1) GD [EEx ia] IIC

Zertifizierungsstelle Explosionsschutz
By order:
Dr.-Ing. U. Gerlach

Braunschweig, July 21, 2003

sheet 1/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

Physikalisch-Technische Bundesanstalt • Bundesallee 100 • D-38116 Braunschweig

nische Bundesanstalt

SCHEDULE

INATION CERTIFICATE PTB 03 ATEX 2074

D533-*** in combination with the Terminal ATSD3S-* or ATSD3D-
n of control commands from the hazardous area into the non-
for the safe electrical isolation of intrinsically safe and non-

mbient temperature is -20 °C up to +70 °C.

..... nominal voltage: U_n = 24 V±10%, (P_n = 2.5 W ... 12 W)
38 maximum voltage: U_m = 60 V

..... nominal voltage: U_n = 5V±10 %, (P_n = 1.2 W)
(a2, b2, a4, b4, a5, b5, a7 to a37, b7 to b37, a39, b39, a40, b40 at the backplane) maximum voltage: U_m = 60 V

Output circuits..... type of protection Intrinsic Safety EEx ia IIA/IIB/IIC
maximum values per circuit
(A1, B1; A3, B3; A5, B5; A7, B7; A10, B10; A12, B12; A14, B14; A16, B16)
Terminal ATSD3S-*
(mode of operation: non-redundant) or
Terminal ATSD3D-*
(mode of operation: redundant)
U_o = 27.16 V
I_c = 108.6 mA
P_o = 738 mW
R_i = 250 Ω
linear characteristic
C_i ≈ 0
L_i ≈ 0

type of protection	EEx ia resp. ib		
	IIA	IIB	IIC
max. permissible ext. inductance L_o	9.9 mH	9.9 mH	0.42mH
max. permissible ext. capacitance C_o	690 nF	690 nF	89 nF

sheet 2/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.

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Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

SCHEDULE TO EC-TYPE-EXAMINATION CERTIFICATE PTB 03 ATEX 2074

In the presence of concentrated capacitances and/or inductances in the intrinsically safe output circuit, the maximum permissible external capacitances and inductances for circuits are to be taken from the following table.

type of protection	EEx ia resp. ib	
	IIB	IIC
max. permissible ext. inductance L_o	2 mH	0.42mH
max. permissible ext. capacitance C_o	300 nF	72 nF

The intrinsically safe output circuits are safely electrically isolated from all other circuits up to a peak value of the nominal voltage of 375 V.

(16) Test report PTB Ex 03-23151

(17) Special conditions for safe use
none

(18) Essential health and safety requirements
Met by compliance with the standards mentioned above.

Zertifizierungsstelle Explosionsschutz
By order:
Dr.-Ing. U. Gerlach

Braunschweig, July 21, 2003

sheet 3/3

EC-type-examination Certificates without signature and official stamp shall not be valid. The certificates may be circulated only without alteration. Extracts or alterations are subject to approval by the Physikalisch-Technische Bundesanstalt.
In case of dispute, the German text shall prevail.
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Revision Information

- Title: Explosion Protection
- Manual No.: TI 33Q01J30-01E

March 2004/1st Edition
Newly published

Apr. 2007/2nd Edition
1.2 Explosion Protection Standards
Revised description of Type “n” standard number in “Table Explosion Protection Standards”
2.1 Explosion Protection Standards that CENTUM has Acquired
Non-Icendive of “Table Explosion Protection Standards that CENTUM Complies” is changed to CSA Non-Icendive.
Added FM Non-Icendive of “Table Explosion Protection Standards that CENTUM Complies”
Revised description of Type “n” standard number in “Table Explosion Protection Standards that CENTUM Complies”
3.1.1 CSA NI (CSA Non-Incendive)
NI is changed to CSA NI.
Revised description of “Signal Wiring”
3.1.2 FN NI (FM Non-Incendive)
Added “FM Non-Incendive”
3.2 Type “n”
Revised description of Type “n”
4.2 Intrinsic Safety Instrumentation Using Barriers
Deleted “Concrete Examples of Connections between CS 3000 System and Barriers”
5.1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
NI is changed to CSA NI.
Revised description of “Lists of CSA NI Compliant Products and CSA NI Parameters”
5.1.2 Lists of FM NI Compliant Products and FM NI Parameters
Added “Lists of FM NI Compliant Products and FM NI Parameters”
5.2 List of Type “n” Compliant Product and the Parameters of Type “n”
Revised description of “List of Type “n” Compliant Product and the Parameters of Type “n””

June 2008/3rd Edition
CENTUM CS 3000 and CS 3000 changed to CENTUM

1.4 Symbols That Indicate Specifications of Explosion Protection
Deleted “CENELEC acceptable product EEx”
2.1 Explosion Protection Standards that CENTUM has Acquired
“Table Explosion Protection Standards that CENTUM Complies”
Revised Conformed standard number
3.1.1 CSA NI (CSA Non-Incendive)
Approved Types and Standards
Revised The CSA Standard No.
3.2 Type “n”
Revised Collected Standards
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Table FIO Parameters (The Load Devices)
Revised to *3 and Remarks
Appendix 2 List of Type “n” Compliant Product and the Parameters of Type “n”
Table FIO Parameters (the Load Devices)
Revised to *3 and Remarks

Apr. 2010/4th Edition

2. CENTUM and Explosion Protection Instrumentation
2.1 Explosion Protection Standards that CENTUM has Acquired
Revised description of “Table Explosion Protection Standards that CENTUM Complies”
2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area
Added “Overview of Connecting a Module with Built-in Barrier (Compliant with CENELEC Standard)”
Added “Overview of Connecting a Module with Built-in Barrier (Compliant with FM Standard)”
4. Intrinsic Safety Explosion Protection Instrumentation
4.1 Intrinsic Safety Explosion Protection Instrumentation Using Module with Built-in Barrier
Added “4.1.1 Intrinsic Safety Explosion Protection of CENELEC Standard”
Added “4.1.2 Intrinsic Safety Explosion Protection of FM Standard”
Appendix 3. List of Parameters of Modules with Built-in Barrier
Added “Table List of Parameters (FM) of Modules with Built-in Barrier”
Added “Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval.”

Oct. 2010/5th Edition

Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
The List of CSA NI Compliant Products
Table The List of CSA NI Compliant Products <for FIO> [AAB141 and AAB842 are added.]
Parameters of CSA NI Compliant Equipments
Table FIO Parameters (The Source Devices) [AAB842 is added.]
Table FIO Parameters (The Load Devices) [AAB141 and AAB842 are added.]
Appendix 2. Lists of Type “n” Compliant Product and the Parameters of Type “n”
The List of Type “n” Compliant Products [AAB141 and AAB842 are added.]
Parameters of Type “n” Compliant Equipments
Table FIO Parameters (The Source Devices) [AAB842 is added.]
Table FIO Parameters (The Load Devices) [AAB141 and AAB842 are added.]

Dec. 2010/6th Edition

Appendix 1.1 Parameters of CSA NI Compliant Equipments
Revised Li for AAT141 (Single) in Table FIO Parameters (The Load Devices)
Appendix 2. Parameters of Type "n" Compliant Equipments
Revised Li for AAT141 (Single) in Table FIO Parameters (The Load Devices)

Jan. 2012/7th Edition

2. CENTUM and Explosion Protection Instrumentation
2.1 Explosion Protection Standards that CENTUM has Acquired
Revised description of “Table Explosion Protection Standards that CENTUM Complies”
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Parameters of CSA NI Compliant Equipments
Table FIO Parameters (The Source Devices) [Style codes (S1 and S2) of the existing AAI135 and AAI835 are added. AAI135 Style S3 and AAI835 Style S3 are added.]

June 2012/8th Edition

2. CENTUM and Explosion Protection Instrumentation
Directly Connected Node is changed into ESB Bus Node
Remote Node is changed into ER Bus Node
2.1 Explosion Protection Standards that CENTUM has Acquired
Revised description of Type “n” standard number in “Table Explosion Protection Standards that CENTUM Complies”
2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area
Figure revised
3. Explosion Protection Instrumentation in Zone 2/Division 2
Directly Connected Node is changed into ESB Bus Node Unit
Remote Node is changed into ER Bus Node Unit
3.1 Non-Incendive
Revised standards
Figure revised
Revised precautions
3.2 Type “n”
Revised Collected Standards
Figure revised
Revised precautions

4. Intrinsic Safety Explosion Protection Instrumentation
Local Node is changed into ESB Bus Node Unit
Remote Node is changed into ER Bus Node Unit
Example of a Connection
Revised to *1 and Remarks
Appendix 1.1 Lists of CSA NI Compliant Product and CSA NI Parameters
The List of CSA NI Compliant Products
Table The List of CSA NI Compliant Products [ANB10S-□1□, ANB10S-□4□, ANB10D-□1□, ANB10D-□4□, ANB11S-□1□, ANB11S-□4□, ANB11D-□1□, ANB11D-□4□, ANT10U-□1□, ANT10U-□4□, CP461, ANT502, ANT512, ANT401, ANT411, AEPV7D-1□□, AEPV7D-4□□ and YCB301 are added.]
Revised precautions
Appendix 1.2 Lists of FM NI Compliant Product and FM NI Parameters
The List of FM NI Compliant Products
Table The List of FM NI Compliant Products [AFV30S,AFV30D, ANB11S, ANB11D, ANT10U, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D-4□□ are added.]
Revised to *2 and Remarks
Parameters of Type “n” Compliant Equipments
Table FIO Parameters (The Source Devices) [AFV30S, AFV30D, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D are added.]
Table FIO Parameters (The Load Devices) [AFV30S, AFV30D, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D are added.]
Revised precautions
Appendix 2. Lists of Type “n” Compliant Product and the Parameters of Type “n”
The List of Type “n” Compliant Products
Table The List of Type “n” Compliant Products [AFV30S-S□14□1, AFV30D-S□14□1, ANB11S-□4□, ANB11D-□4□, ANT10U-□4□, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D-4□□ are added.]
Revised to *2 and Remarks
Parameters of Type “n” Compliant Equipments
Table FIO Parameters (The Source Devices) [AFV30S, AFV30D, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D-4□□ are added.]
Table FIO Parameters (The Load Devices) [AFV30S, AFV30D, CP461, ANT502, ANT512, EC402, ANT401, ANT411 and AEPV7D-4□□ are added.]
Revised precautions
Appendix3. Lists of Parameters of Modules with Built-in Barrier
Revised description of “Table List of Parameters (CENELEC) of Modules with Built-in Barrier”
Revised description of “Table List of Parameters (FM) of Modules with Built-in Barrier”
Revised parameters
Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval
Table 1-Entity Parameters
Revised note

Sep. 2012/9th Edition

2.1 Explosion Protection Standards that CENTUM has Acquired
Revised description of “Table Explosion Protection Standards that CENTUM Complies”
4. Intrinsic Safety Explosion Protection Instrumentation
Example of a Connection
Revised to Remarks
Figure revised
Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval
Table 1-Entity Parameters
Revised note

Apr. 2013/10th Edition

1.2 Explosion Protection Standards Table Explosion Protection Standards [Revised descriptive texts]
1.3 Classification of Explosion Protection Equipment
Revised descriptive text (4)
[Added about ic equipment]
Table Classification of Hazardous Area
[Intrinsic safety (ic) is added.]

1.4 Symbols That Indicate Specifications of Explosion Protection
Europe, Australia, IEC
[Revised descripteve texts]
2.1 Explosion Protection Standards that CENTUM has Acquired
Table Explosion Protection Standards that CENTUM Complies
[Revised “Conformed standard number”]
2.2 Explosion Protection Construction that I/O Devices of CENTUM Comply
[Revised descriptive text and figure]
2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area
[Revised descriptive texts and figures]
3.1.1 CSA NI (CSA Non-Incendive)
Approved Types and Standards
[Revised the writing style]
3.1.2 FM NI (FM Non-Incendive)
Complied Standards
[Revised the writing style]
Device Installation
[Revised descriptive texts]
3.2 Type “n”
Revised descriptive texts and writing style of complied standards
Type “n” Approved Products and Their Configuration Example
[Revised figures]
Device Installation, Maintenance, Wiring, and Signal Wiring
[Revised descriptive texts]
Display of Parameters of the Type “n” Devices, and How to Compare Parameters
[Deleted all]
Connecting ESB Bus Node Unit and a Device Installed in Zone 2
[Revised descriptive texts and figures]
Installing ER Bus Node Unit in Zone 2 (Wiring by ER Bus)
[Revised descriptive texts and figures]
Installing ER Bus Node Unit in Zone 2 (Wiring by Optical cable for ER Bus)
[Revised descriptive texts and figures]
Installing Optical ESB Bus Node Unit in Zone 2 (Wiring by Optical cable for Optical ESB Bus)
[Revised descriptive texts and figures]
Installing a FCS or ESB Bus Node Unit in Zone 2
[Revised descriptive texts and figures]
4.1.1 Intrinsic Safety Explosion Protection of CENELEC Standard
Wiring of Intrinsic Safety Explosion Protection
[Revised document number]
Connect ESB Bus Node Unit to Equipment of Zone 0/1/2 Setting
[Revised document number]
Set ER Bus Node Unit and Module with Built-in Barrier in Zone 2
[Revised document number]
4.1.2 Intrinsic Safety Explosion Protection of FM Standard
Connect ESB Bus Node Unit to Equipment of Division 1/2 Setting
[Revised descriptive texts]
Set ER Bus Node Unit and Module with Built-in Barrier in Division 2
[Revised descriptive texts]
Set Optical ESB Bus Node Unit and Module with Built-in Barrier in Division 2
[Revised descriptive texts]
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Table The List of CSA NI Compliant Products <for FIO>
[Revised Type names]
Table FIO Parameters (The Source Devices)
[Revised Module name]
Table FIO Parameters (The Load Devices)
[Revised Module name]

Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters
Table The List of FM NI Compliant Products
[Revised Type names]
Table FIO Parameters (The Source Devices)
[Revised Module name]
Table FIO Parameters (The Load Devices)
[Revised Module name]
Appendix 2. Lists of Type “n” Compliant Product and the Parameters of Type “n”
[Revised title]
Table The List of Type “n” Compliant Products
[Revised Type names]
Parameters of Type “n” Compliant Equipments
[Deleted all]
Table 1-Entity Parameters
[Revised descriptive texts]

Sep. 2013/11th Edition
3.1.1 CSA NI(CSA Non-Incendive)
Installing ER Bus Node Unit in Division 2
[Revised model names]
3.2 Type "n"
Complied Standards
[Revised descriptive texts]
4.2 Intrinsic Safety Explosion Protection Instrumentation Using Barriers
Example of Connection at the Barrier in Use (Connection Using Marshalling Panel)
[Revised figures]
Appendix 1. List of NI Compliant Products and NI parameters
Table The List of CSA NI Compliant Products <for FIO>
[Revised type names]
Table FIO Parameters (The Source Devices)
[Revised Module names]
Table FIO Parameters (The Load Devices)
[Revised Module names]
Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters
Table The List of FM NI Compliant Products
[Revised type names]
Table FIO Parameters (The Source Devices)
[Revised Module names]
Table FIO Parameters (The Load Devices)
[Revised Module names]
Appendix 2. Lists of Type "n" Compliant Product
Table The List of Type "n" Compliant Products
[Deleted ADR541, ATC4S, and AKB334]

July 2014/12th Edition
1.4 Symbols that Indicate Specifications of Explosion Protection
Europe, Australia, IEC
[Revised descriptive texts]
2.1 Explosion Protection Standards that CENTUM has Acquired
Table Explosion Protection Standards that CENTUM Complies
[Revised descriptive texts]
3.1.2 FM NI (FM Non-Incendive)
Complied Standards
[Revised descriptive texts]
3.2 Type “n”
Complied Standards
[Revised descriptive texts]
4.1.2 Intrinsic Safety Explosion Protection of FM Standard
Explosion-proof Specifications and Complied Standard
Complied Standards
[Revised descriptive texts]

Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters
Table The List of FM NI Compliant Products
[AW810D, VI461, and PW441/442/444 are added]
Table FIO Parameters (The Source Devices)
[AW810D and VI461 are added]
Table FIO Parameters (The Load Devices)
[AW810D, VI461, and PW441/442/444 are added]
Appendix 2. Lists of Type “n” Compliant Product
Table The List of Type “n” Compliant Products
[AW810D, VI461, and PW444 are added]

Oct. 2014/13th Edition
4.1.2 Intrinsic Safety Explosion Protection of FM Standard
Connect ESB Bus Node Unit to Equipment of Division 1/2 Setting
[Revised descriptive texts]
Set ER Bus Node Unit and Module with Built-in Barrier in Division 2
[Revised descriptive texts]
Set Optical ESB Bus Node Unit and Module with Built-in Barrier in Division 2
[Revised descriptive texts]
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Table The List of CSA NI Compliant Products <for FIO>
[Added ANT421 and ANT522]
Table FIO Parameters (The Source Devices)
[Added ANT421 and ANT522]
Table FIO Parameters (The Load Devices)
[Added ANT421 and ANT522]
Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters
Table The List of FM NI Compliant Products
[Added ANT421 and ANT522]
Table FIO Parameters (The Source Devices)
[Added ANT421 and ANT522]
Table FIO Parameters (The Load Devices)
[Added ANT421 and ANT522]
Appendix 2. Lists of Type “n” Compliant Product
Table The List of Type “n” Compliant Products
[Added ANT421 and ANT522]
Appendix 4. Installation of I/O Modules with Built-in Barrier in accordance with FM Approval
Table 1-Entity Parameters
[Revised descriptive texts]

Feb. 2015/14th Edition
3.1.1 CSA NI (CSA Non-Incendive)
Power Supply wiring
[A1BD5D is added]
Signal Wiring
[A1BD5D is added]
Instruction on Contact Input Mode Wiring
[A1BD5D is added]
Instruction on Voltage Input Mode Wiring
[A1BD5D is added]
3.1.2 FM NI (FM Non-Incendive)
Power Supply Wiring
[A1BD5D is added]
Signal Wiring
[A1BD5D is added]
Instruction on Contact Input Mode Wiring
[A1BD5D is added]
Instruction on Voltage Input Mode Wiring
[A1BD5D is added]
3.2 Tpe "n"
Complied Standards
[A1BD5D is added]

Instruction on Contact Input Mode Wiring
[A1BD5D is added]
Instruction on Voltage Input Mode Wiring
[A1BD5D is added]
Appendix 1.1 Lists of CSA NI Compliant Products and CSA NI Parameters
Table The List of CSA NI Compliant Products <for FIO>
[A1BD5D, A1BA4D, A1BR4D, an A1BT4D are added]
Table FIO Parameters (The Load Devices)
[A1BD5D is added]
Appendix 1.2 Lists of FM NI Compliant Products and FM NI Parameters
The List of FM NI Compliant Products
Table The List of FM NI Compliant Products
[A1BD5D, A1BA4D, A1BR4D, an A1BT4D are added]
Parameters of FM NI Compliant Equipments
Table FIO Parameters (The Load Devices)
[A1BD5D is added]
Appendix 2 Lists of Type "n" Compliant Products
The List of Type "n" Compliant Products
Table The List of Type "n" Compliant Products <for FIO>
[A1BD5D, A1BA4D, A1BR4D, an A1BT4D are added]

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Introduction [Revised descriptive texts]
Safety Precautions
Safety, Protection, and Modification of the Product [Added a symbol]
1.2 Explosion Protection Standard in Each Country [Deleted]
ATEX Directive [Exchanged CENELEC to ATEX]
1.3 Classification of Explosion Protection Equipment
Table Classification of Hazardous Area [Changed the classification]
Classification of Explosive Gas [Exchanged CENELEC to ATEX]
2.1 Explosion Protection Standards that CENTUM has Acquired
Table Explosion Protection Standards that CENTUM Complies
[Revised Conformed standard number]
2.2 Explosion Protection Construction that I/O Devices of CENTUM Comply
[Added note for safety barrier]
2.3 Overview of Connecting CENTUM to the Devices Installed in a Hazardous Area
Overview of Connecting a Module with Built-in Barrier (Equipment Compliant with Intrinsic Safety Explosion Protection) with Devices [Exchanged CENELEC to ATEX]
Figure Connection of a Module with Built-in Barrier (Compliant with CENELEC Standard) (1)
[Deleted Type “n” explosion protection equipment]
Figure Connection of a Module with Built-in Barrier (Compliant with CENELEC Standard) (2)
[Deleted Type “n” explosion protection equipment]
Figure Connection of a Type “n” Compliant Module (2) [Added note for safety barrier]
Figure Connection of an NI Compliant Module (1)
[Exchanged “Flameproof wiring” to “Wiring for Div.1/Div.2” and deleted note]
Figure Connection of an NI Compliant Module (2)
[Exchanged “Flameproof wiring” to “Wiring for Div.1/Div.2” and deleted note]
Overview of connecting N-IO components [Added]
3.1.1 Approved Types and Standards [Deleted Standards]
3.1.2 FM NI (FM Non-Incendive) [Exchanged CENELEC to ATEX]
3.2 Complied Standards [Deleted Standards]
4.1.1 Intrinsic Safety Explosion Protection of CENELEC Standard [Exchanged CENELEC to ATEX]
Appendix 3 Lists of Parameters of Modules with Built-in Barrier
Table List of Parameters (CENELEC) of Modules with Built-in Barrier
[Exchanged CENELEC to ATEX]

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